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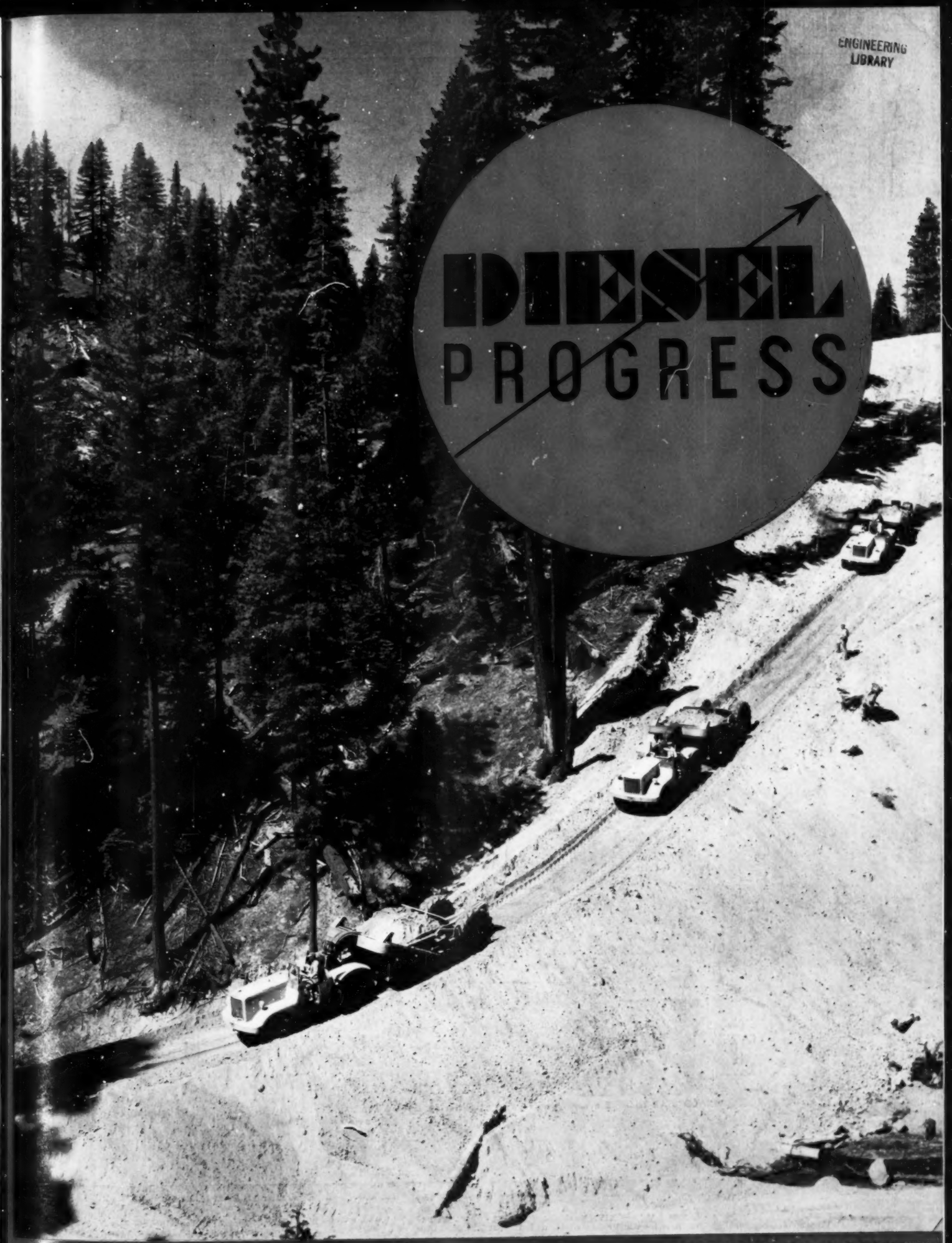

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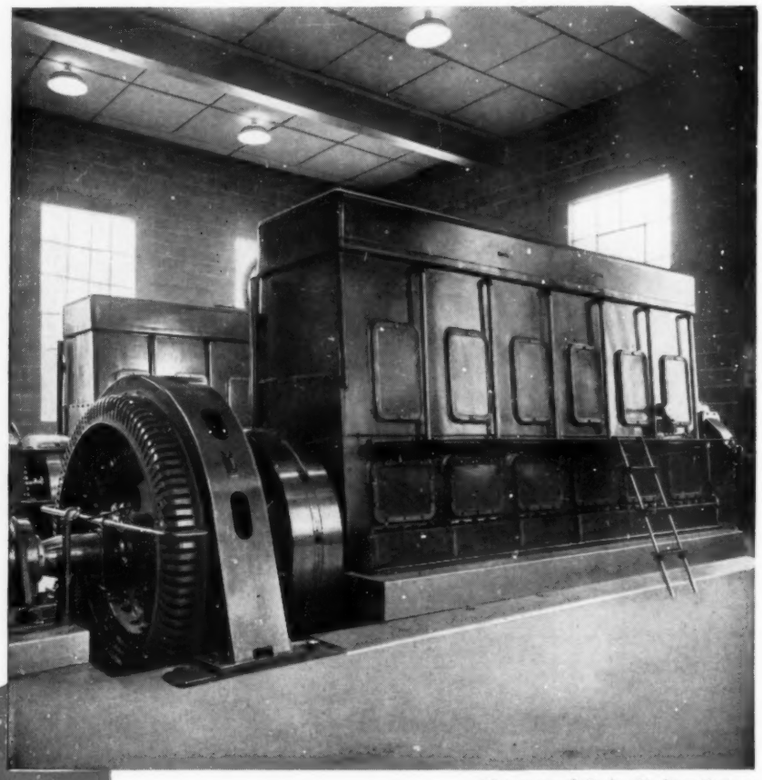

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DIESEL and GAS ENGINE PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

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DIESEL PROGRESS for April, 1948, Vol. XIV, No. 4. Published monthly by Diesel Engines, Inc., 2 West 45th Street, New York 19, N. Y. Tel. MUrray-Hill 2-7333. Subscription rates are $5.00 for U.S.A. and possessions. All other countries $7.50 per year. Subscriptions may be paid the London office at £1-17s per year.

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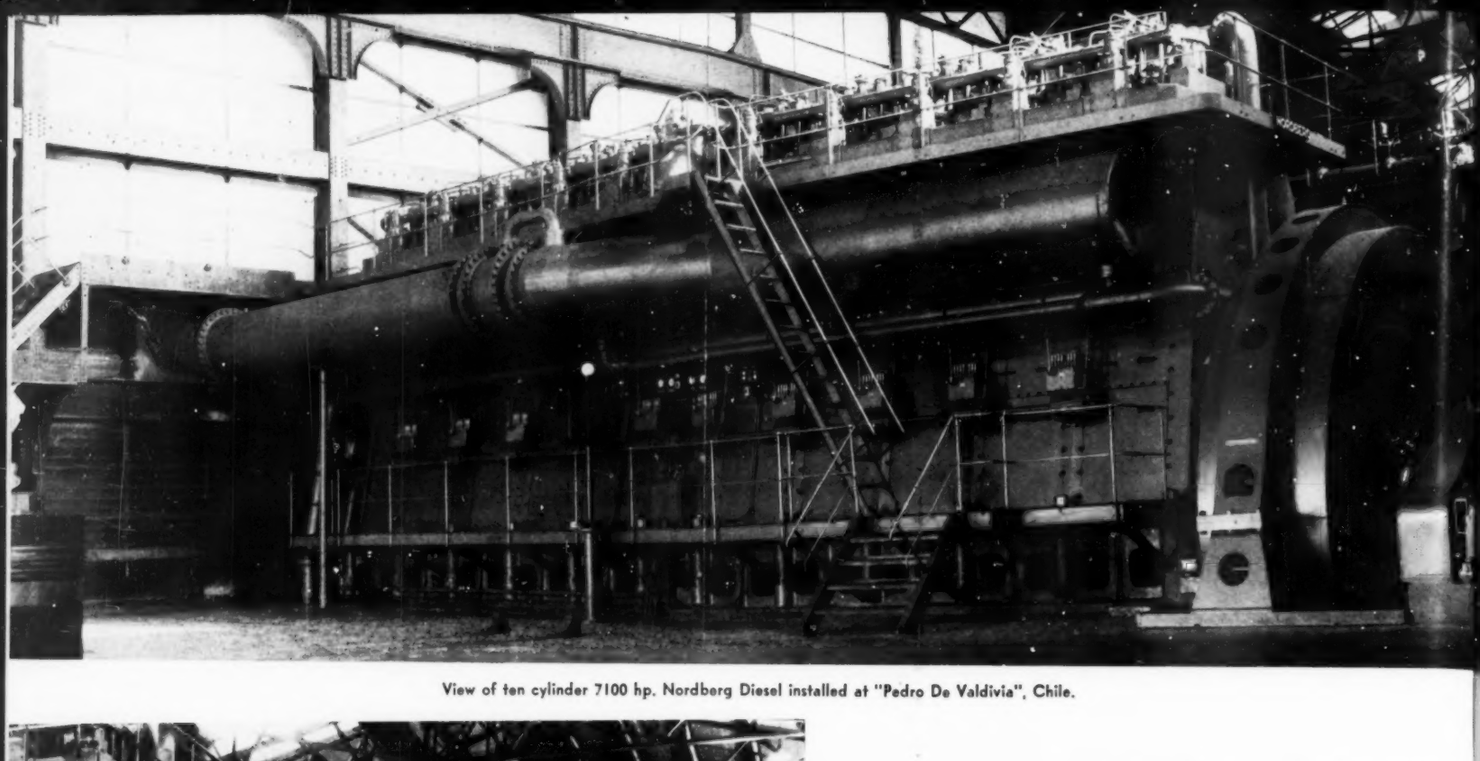
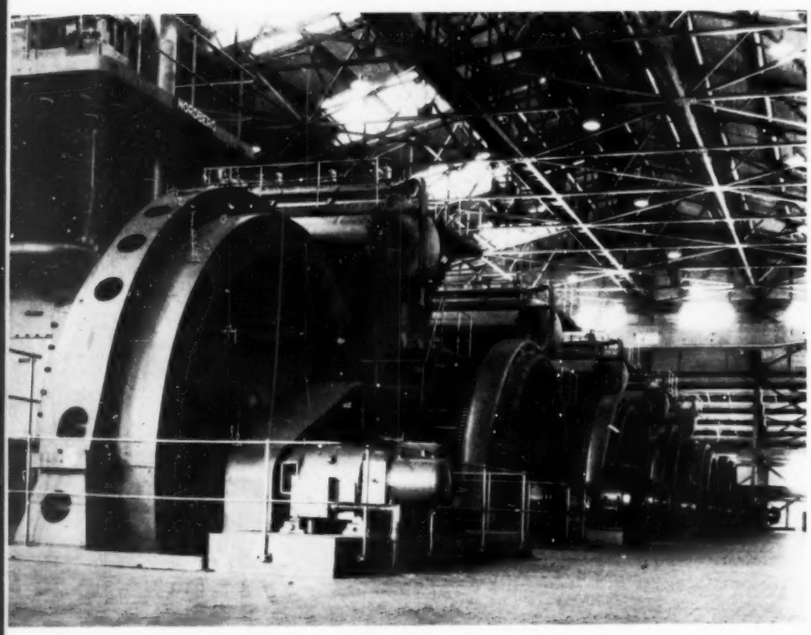


View of ten cylinder 7100 hp. Nordberg Diesel installed at "Pedro De Valdivia", Chile.



Diesel lineup at plant—Nordberg Diesel (left foreground) five 4700 hp. double acting two cycle M.A.N. Diesels complete picture.

NEW DIESEL FOR CHILEAN NITRATE INDUSTRY

South America's Largest Diesel-Electric Grid System Described

By C. J. RUEGGER

Panoramic view of Pedro de Valdivia plant. Below is seen the general office. Control and experimental laboratory with workmen's townsite in background. Warehouses and material storage yards in foreground. Reverberatory furnaces with waste heat boilers and grain-

PEDRO de Valdivia, the largest plant of its kind in the Northern part of Chile, was built during 1930 to 1932 for the production of Sodium Nitrate, the natural fertilizer. The plant is owned and operated by the Lautaro Nitrate Co., Ltd., and it is located about 100 miles North of the port of Antofagasta, Chile, 50 miles inland and 5,000 feet above sea level.

The nitrate bearing rock is mined in the vicinity of the plant by the familiar method of open pit mining where, at present, 24 Bucyrus 100-B electric shovels and draglines are employed. The ore is hauled from the mine to the plant by 23-36 ton locomotives over an electrical 42 in. gauge railroad. The 30,000 tons of nitrate bearing rock, which represents the average daily production, then passes through the crushing plant where it is reduced and screened to a size of about ⅝ in. mesh.

A series of 48 in. conveyors carries this product from the crushers and dumps it into a group of large concrete vats where the nitrate salts are leached out. The residues are dug out by large clam shell excavators and hauled away by electric locomotives to the tailings dump.

The concentrated brine coming from the leaching vats is pumped to the crystallizing plant where the sodium nitrate is recovered by means of refrigeration and centrifuging.

On account of its hygroscopic nature and small, even crystal size, which makes the crystallized nitrate difficult to handle and ship, it is dehydrated by melting in reverberatory furnaces and granulated by means of spraying into an air cooled chamber. The final product, some 2,000 tons daily, then is shipped in bulk or bags over about 65 miles of a narrow gauge (42 in.) railroad down to Tocopilla, the port of embarkation.

The plant consumes approximately 10,000 tons of water per day. Part of this is supplied from a Government pipe line bringing down fresh water from the mountains, but the major portion is brackish water which is pumped from a river running through the desert some 26 miles away.

To supply the necessary power for these operations, the company provided, with the original construction of the plant, a power house containing five 4,700 hp. double acting two cycle air injection, M.A.N. Diesel engine generators. These units produce power at 60 cycles and 6,600 volts which is also the distribution voltage throughout the entire plant and mine.

About 20 miles North of "Pedro de Valdivia" there is another similar plant called "Maria Elena," comparable in size to the former and belonging to the Anglo-Chilean Nitrate Co., the owners of the partially electrified railroad to port. This plant also has a Diesel engine power house with a total of about 24,000 hp. installed capacity.

The two power houses are connected together by means of a 33,000 volt transmission line which also extends to Tocopilla, where the whole system, which represents the largest Diesel power block in South America, is tied in with that of the steam plant of the Chile Exploration Co. Diesel power was selected for the nitrate plants essentially for the greater efficiency of the engines and so that the heat energy contained in the cooling water and exhaust gases could be used conveniently for heating the leaching solutions.

The gradual improvements in mechanization within the past 10 years and, in particular, the contemplated plant extensions to meet the increased world demand for Chilean nitrates after the war, called for a substantial addition to the power installation. For that reason, the Lautaro Nitrate Company purchased in 1946, together with other units, a large Diesel engine generator from the Nordberg Mfg. Co. This engine is a 10 cylinder, two cycle, single acting Diesel with a sea level rating of 7,100 bhp. at 164 rpm., and it is arranged for direct connection to a General Electric flywheel type, 3 phase, 6,600 volt alternator of 6,250 kva. capacity with 80% power factor. At the altitude of 5,000 feet above sea level at "Pedro de Valdivia," this engine is guaranteed to develop 6,400 bhp.

General Engineering Arrangement

The general design of the two cycle single acting Nordberg engine is well known to Diesel engineers and therefore does not need to be described.

Inasmuch as this unit was an addition to the existing power house, the foundations, as well as general arrangement, were engineered by the company's local plant staff.

The original layout of the power house provided room for the installation of two more units for which the sub-foundation No. 6, with all its reinforcing steel, was put in up to the basement floor level when the power house was built. Also extensions had been provided for all of the auxiliaries. To fit the Nordberg engine into the power house was, therefore, a problem only insofar as it differed in size to the existing M.A.N. units.

The new engine was selected with a separate motor driven scavenging air blower, in spite of the fact that all of the other units in the power house have direct connected scavenging air pumps. The fresh air duct which already existed in the basement floor provided a neat arrangement for a turbo blower and, by eliminating the scavenging air pump on the end of the engine, a considerably larger unit could be fitted into the available space in the engine room. Thus, it was possible to fit in the Nordberg TS-2910, which is a ten cylinder single acting, two cycle, crosshead type engine, with mechanical injection, into practically the same space as that occupied by a M.A.N. 7 cylinder engine with a built-on air pump.

With the sub-foundation already in place the location of the center of the new engine therefore was

ing plant in background. Part of reject dump can be seen in far background.

Machine shops and locomotive shed in foreground. Power house, crystallizing plant and concrete vats are in background.

Reject excavators over vats are barely visible (ore cars with crushing plant in background.

given, and esthetic considerations, such as lining up the new generator with the existing ones, determined the other positions.

As illustrated in figure 2 the scavenging air blower unit was designed to be located in a pit alongside the foundation about 8 feet below basement floor level. The reason for this location was the fact that the fresh air duct coming from the plenum chamber, as mentioned above, already existed underneath the basement floor. Moreover, by lowering the blower unit, sufficient room was made available so that the intermediate distributing header for the scavenging air could be put underneath the beams of the engine room floor. This design was definitely preferable to the original layout which placed the blower on the basement floor, and the intermediate distributing header above engine room floor on the level of the scavenging air duct of the engine proper, which in turn would have made this whole side, from which most of the repairs will have to be made, more or less inaccessible for crane service.

The blower unit selected for this job was furnished by the Elliott Company, Jeannette, Pennsylvania. The specifications called for a single stage centrifugal type, for a capacity of 34,500 cfm., with a pressure differential of 3.25 psi. at 3,450 rpm., and 0. psi. air intake, and designed to form one unit with a directly connected 700 hp., 6,600 volts, 3 phase, 60 cycle, squirrel cage induction motor, arranged so as to receive power via a reduced voltage starter straight from the station bus.

A combination main and auxiliary exciter, "V" belt driven at 850 rpm., was designed to be placed on the sole plate next to the outboard bearing. The belt drive, protected by a guard, was mounted on the extension shaft on the inside of the bearing and over the generator pit in order to simplify the foundation design and to provide the widest possible space in front of the generator. This arrangement necessitated a split sheave and adjustable "V" belts.

Engine Foundation

It was decided that the engine foundation should be made flush with the engine room floor, which is somewhat different from the usual practice in the U. S. A., where most of the larger size engines are mounted below operating floor level. This practice has the admitted advantage of easier access to the covers and the internal running gear of the engine. However, the decision for the Pedro de Valdivia design was governed by the fact that the power house has a basement where it would have been necessary to erect a steel structure for the floor beams had it not been possible to support them on the engine foundation. Moreover, the extra height gained by setting the unit up on the engine room floor level afforded a much smoother exhaust pipe run over the mezzanine floor to the exhaust silencer.

This was of considerable importance inasmuch as it was necessary for various reasons to have all of the exhaust pipes water cooled.

On account of seismic shocks, which are a frequent occurrence in this part of the world, it has long been established that it is necessary to build great strength into the foundations for reciprocating engines in order to maintain alignment. This was especially true in the case of the Nordberg unit, where the foundation projected considerably above basement floor level and it was considered to be imperative not only to provide a steel sole plate on top for the shims, but to also make this sole plate an integral part of a structural steel base, which included the steel frame for the generator, all of which was cast into the concrete to serve as reinforcing for the foundation itself.

The sole plate was machined, using an inverted shaper, after the foundation was completed, in order to provide truly levelled patches each large enough to accommodate a 22 in. x 7 in. steel liner of 1¼ in. thickness. Since it was necessary to change the set up of the shaper a number of times in order to cover the full length of the foundation, it was impossible to machine all of these patches exactly to the same level. The difference, therefore, had to be taken up in the thickness of the steel liners. Illustration shows the way these liners were spaced. It also shows the pockets which were provided in the concrete to give access to the lower nuts and square washers of the foundation bolts. These anchors are not grouted in and, therefore, can be changed easily in case of breakage.

The four wedge blocks, also visible in drawing, were provided to prevent a possible sideward movement of the engine bedplate.

A niche was built into the generator foundation on the plenum chamber side to accommodate the instrument transformers for the generator differential protection.

Inasmuch as the foundations were of local design and the structural steel base was fabricated in the Pedro de Valdivia machine shops, the whole of the foundations, including those for the auxiliary equipment in the basement, were built and finished well in advance of the arrival of the engine.

Erection of Engine

The engine was delivered and shipped from Milwaukee, Wis., in April 1947. It arrived at the port of Tocopilla on June 2nd. Tocopilla is an open harbor and is not equipped with modern unloading facilities. All cargo has to be unloaded from the ocean going vessels into lighters, and then transported to the moles. A relatively calm sea is necessary for such operations, especially when heavy lifts are to be handled.

Unfortunately, the winter months of 1947 were exceptionally bad for Tocopilla, heavy swells persisted for weeks. The *Cape Georgia* with the engine on board was forced to stand by for several weeks. Most of the lighter pieces were taken off when the boat called at Tocopilla on its south bound trip, but the heavy lifts, such as the bedplate sections which were needed first, could not be unloaded into lighters until June 17th, when the *Cape Georgia* stopped again at Tocopilla on its way North.

Practically all of the equipment belonging to the engine proper, except the bedplate, the generator and switchgear, had arrived at the plant during the second half of June when erection began.

Considering the great hazards involved during unloading operations in port, surprisingly little damage was done. With the exception of two cylinder block studs which were bent and had to be made new, practically all of the pieces arrived in good shape.

An erection crew of 24 men was formed by taking mechanics and helpers from the repair gangs of both power houses. A mechanics foremen and a plant engineer, who served as interpreter, provided the necessary liaison between the factory's erection-superintendent and the crew.

During the waiting period prior to the arrival of the two crankcase halves, many of the smaller pieces were taken into the power house, where they were cleaned and prepared for erection. Also a considerable amount of other work was done. The starting air tanks were installed near the East wall of the power house for easy access. The Ross coolers, sump tank, circulating luboil pumps, as well as all of the other auxiliaries were placed in the basement. This gave the pipe fitters an early start on their assignment to make all of the heavy pipe connections, which were supplied from the local shops, for the water and luboil circuits to the engine.

The bedplate arrived finally at the end of June. After thorough cleaning and inspection of all machined surfaces, the oil pans were bolted to the underside of the bases and each half was put in its respective place on the foundation. The shims, as mentioned before, had all been machined, fitted and gauged with an 8 foot straight edge to provide an absolute level surface. As a consequence, no difficulties were encountered in matching the two crankcase halves. Once they were joined, with the shrunk keys in place, all of the supporting shims were tested with a hammer for tightness before the foundation bolts were pulled up. Some of the 46 shims were loose, but, by changing around, only three had to be replaced. Considerable care was taken in the alignment of the base, so as to make certain that the bedplate was in perfect level and that all of the 46 shims were each carrying an equal load. This operation took about 5 days.

(Right) Foundation plans for Nordberg Diesel installation.

(Below) Fig. 1. View showing arrangement of lube oil sump tank, gear pumps, Honan Crane Purifiers, and Ross oil coolers.

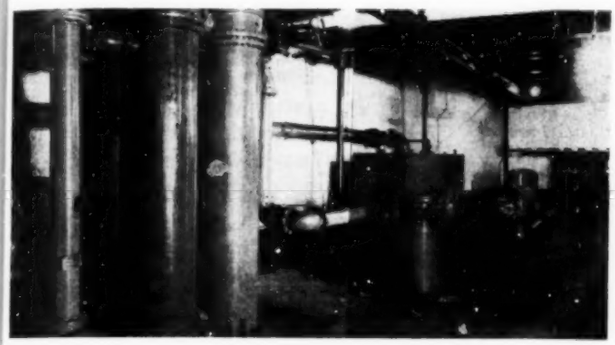


Fig. 2. Scavenging air blower unit located in pit in basement floor is of Elliott manufacture with 34,500 cfm. capacity.

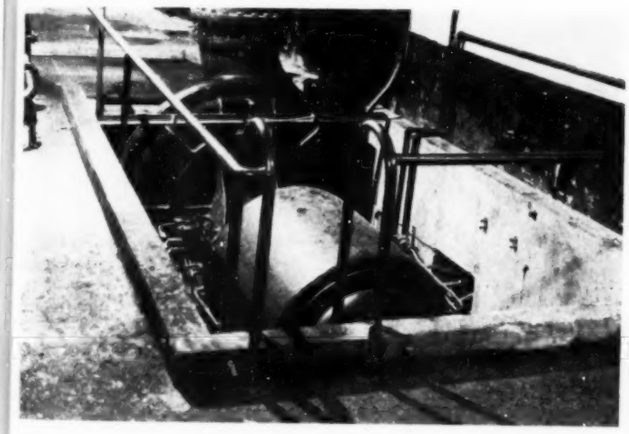


Fig. 3. Engine gauge board arrangement at operator's stand.

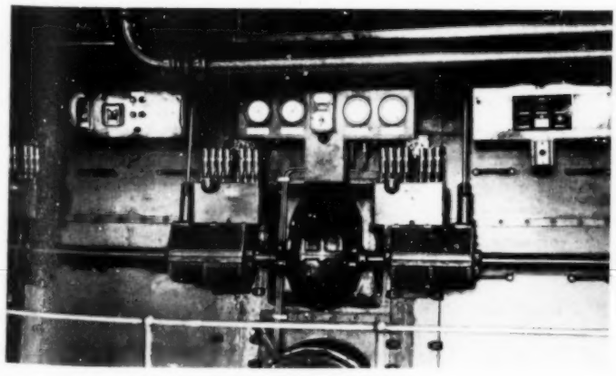
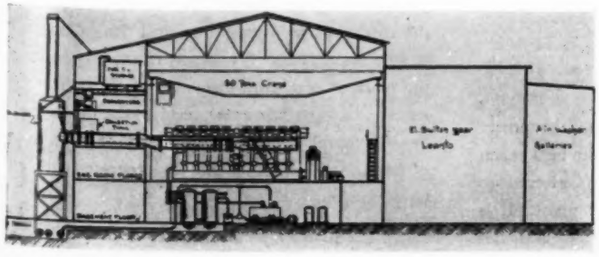
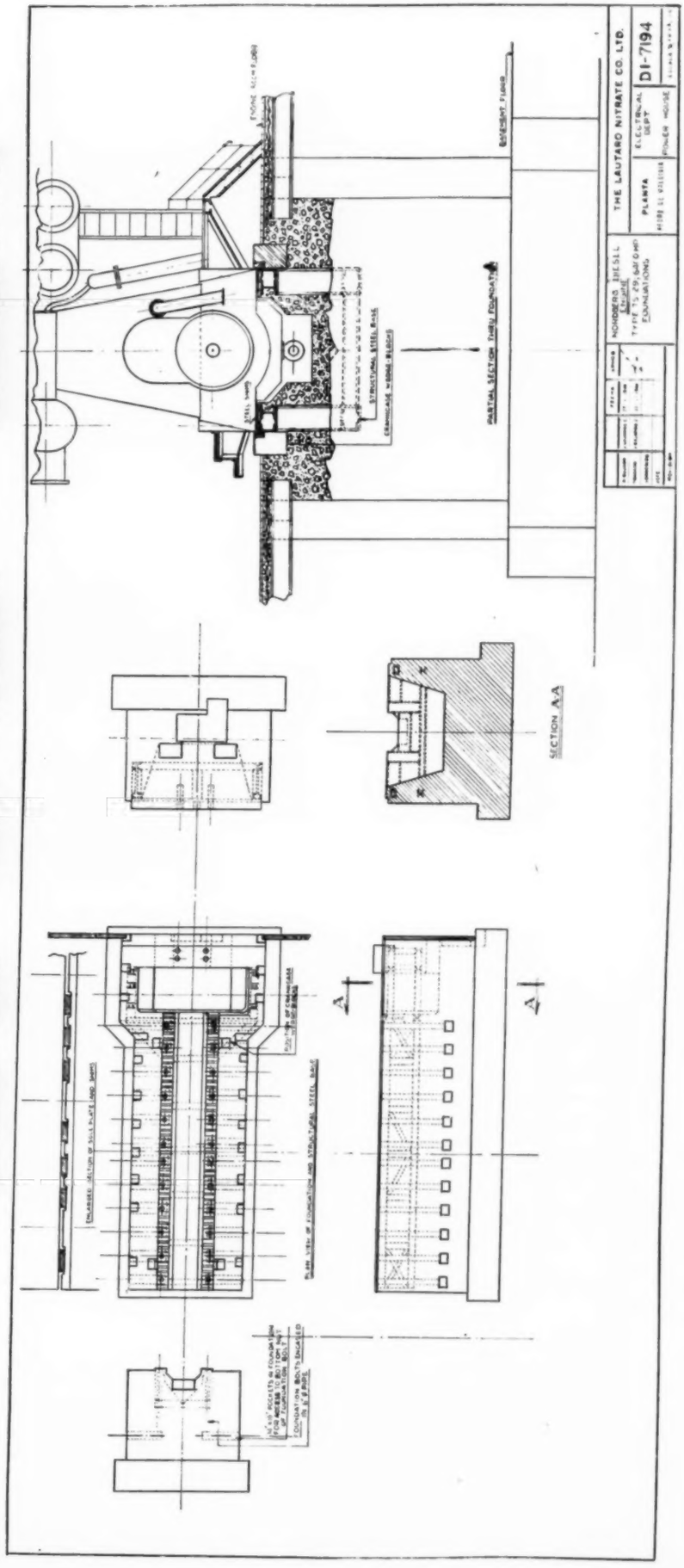


Fig. 4. Elevation of new Nordberg Diesel engine generator.





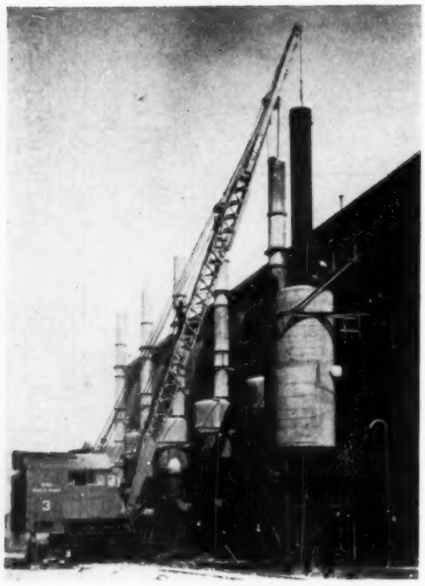


Fig. 5. Erection of Maxim exhaust silencer on supporting steel structure.

With the base firmly in place, a line was pulled through the center of the bearings for the purpose of locating the outboard bearing and generator stator foundations.

All of the above work was finished on the 8th of July and from then on, the erection superintendent with his crew concentrated on putting the engine together, following step by step the factory's instructions in fitting the parts together. During this same period, another gang was busy putting up the auxiliaries in the basement and the exhaust silencer outside the building.

The extension shaft to the outboard bearing was installed on September the 8th, and the erection of the generator and exciter was finished September 17th. Two additional gauge boards were manufactured in the local shops and installed alongside the instrument panel supplied with the engine. One was for the electrical controls of the Elliott turbo-blower and the other one for the Viking signalling control equipment supplied with the pressure luboil system.

Fig. . View of Honan Crane purifiers and lube oil pumps in basement of plant.

Everything was ready at the beginning of October and the engine first ran on October 8th.

The preliminary test runs were carried out without the slightest difficulty. Not a single bearing heated on the entire engine, reflecting the factory's workmanship and the thorough care with which it was assembled.

Starting Air Equipment

As mentioned previously, the M.A.N. units are of the air injection type. Each engine is equipped with a 1,000 psi. air compressor. Therefore, sufficient high pressure air was available from the five units for the purpose of starting the new engine. The Nordberg unit, however, was designed to start with only 250 psi., which would have required air reservoirs of a capacity too large for the space which was available. It was decided, therefore, to install four 1,000 psi. tanks of 23 cubic foot capacity and one 50 cubic foot, 250 psi. tank to act as an equalizer between the engine and the pressure reducing valve, through which the air from the 1,000 psi. tanks was to be supplied. These air bottles were set up against the East wall of the engine room and their elevation was arranged so as to make the valve gear on top easily accessible from the operator's gallery.

Exhaust Headers

The 30 in. I.D. exhaust headers of the Nordberg engine differ from the standard factory design in that they are water cooled as far as the silencer, instead of having simple insulation. This special feature was specified by the Lautaro Company for the principal purpose of recovering more heat from the engine exhaust which, as was mentioned previously, is used in the process for heating the leach solution in the reduction plant.

The exhaust pipes are of welded steel plate construction, with rubber expansion joints in a number of places between flanges of the inner wall and the water jackets, to take care of any possible temperature stresses between the inner and outer shells. Since the header assemblies themselves are firmly clamped against the cylinder blocks of the engine, corrugated steel expansion joints were provided at the other end to form the connection between the header assemblies and the silencer.

The muffler, which has two side inlets of 32 in. diameter and a top outlet of 42 in., is 26 feet high, 9 ft. 9 in. in diameter and it weighs approximately 15 tons. It was specially built by the Maxim Silencer Co., and the supporting structure on the outside of the building was designed and fabricated in the local shops.

Cooling Water System

The existing cooling water system for the power house was specially designed so that the heat taken away from the engines could be transferred to the leaching solutions of the nitrate plant. It is a semi-closed system including a cold and hot water sump of approximately 1,000 tons capacity each. A battery of eight 1,540 gpm. single stage centrifugal pumps circulate the cold water through the engines and back to the water sump. Another group of ten 1,230 gpm., two stage centrifugal pumps forced the water from the hot water sump through a series of 15 heat exchangers cooled by nitrate solutions from where it returns to the cold sump. A shunt circuit is also provided to permit passing the return water over a group of forced draft cooling towers if, for any reason, the heat transfer cannot be balanced by exchangers.

The whole system was amply designed originally, and only one extra hot water pump and three cooling towers to take care of the requirements of the Nordberg unit had to be added.

Fresh water of 6 to 8 degrees French hardness is used throughout the whole system, but a Permutit plant of sufficient capacity has been installed as standby to provide the full make up with treated river water, in case the ordinary fresh water supply is inadequate.

In order to facilitate the transfer of heat from the cooling water to the leach solutions, it is necessary to operate the cooling water system at a temperature level higher than customary practice. The incoming water temperature varies between 115° and 125° F., while the average temperature level of the hot water sump is around 135° F.

Under full load conditions, the Nordberg engine will consume about 1,800 gpm. and will raise the water temperature roughly 15° F.

Lube Oil System

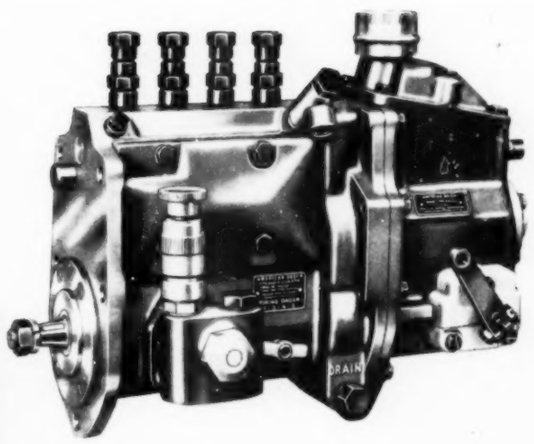
The lubricating oil system, as it was installed originally in the power house for the five M.A.N. units, consists of a centralized storage and cleaning system from which all of the new and reconditioned oil is distributed to the engine luboil sump tanks as required. In contrast to this, the luboil system of the Nordberg engine is designed to be completely self contained, with its own filtering and purifying equipment. The two systems were, therefore, kept entirely independent, which also has the advantage of permitting the use of a different grade of luboil for the new unit.

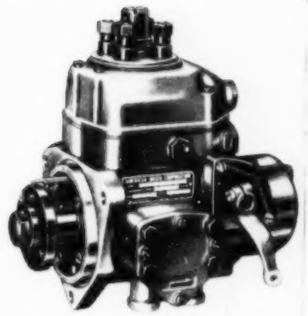
Each of the power cylinders of the Nordberg engine is lubricated through seven quills by a multi-feed timed lubricator of special design made by Manzel Inc. The luboil used for this purpose is a good quality high viscosity oil and the consumption averages around .85 gallons per engine hour. This oil is piped to the engine from the main storage tank located in the power house leanto and each lubricator receives the oil through an individual feeder tap, insuring, thereby, ease of handling, cleanliness and an accurate check on consumption.

. . . . . *And now please turn to page 50* . . . . .

Dimensional and Weight Comparison, American Bosch APE and PSA Pumps

Type APE 4A Injection Pump Assembly (with Fuel Supply Pump and Governor)	Type PSA 4A Injection Pump Assembly (with Fuel Supply Pump and Governor)
LENGTH— approx. 14 9/32"	LENGTH— approx. 8⅞"
HEIGHT— approx. 11 13/16"	HEIGHT— approx. 8 11/32"
OVERALL WIDTH— approx. 6 19/32"	OVERALL WIDTH— approx. 5 31/32"
WEIGHT—26 lbs.	WEIGHT—13 lbs.





NEW FUEL INJECTION PUMP FOR AUTOMOTIVE DIESELS

THE American Bosch Corporation has recently announced its new single-plunger type PSA fuel injection pump for automotive Diesel engines, which pump is known to have been under development for the past several years.

As might be expected, the new pump is being produced initially in a size identified as the PSA.A (Fig. I) which is suitable primarily for small Diesel engines on which the cost of injection equipment has long been a disproportionately great burden. The ultimate manufacturing cost of the PSA is likely to be only half that of its conventional predecessors, which means that entirely new markets may be opened to the Diesel. Furthermore, the new pump is much more readily serviced, so that its savings are extended into maintenance, where costs have also been too high.

The new type PSA pump is built with the same precision as earlier types; its lower cost is inherent in its design, which is very simple, requiring many fewer parts. A single plunger and a single delivery valve do the work formerly allocated to four or six plungers and delivery valves, depending upon the number of cylinders to be served. The pump complete with governor and supply pump has less than half the size and weight of present multi-plunger pumps of equal capacity. All this is tangible evidence of a high degree of cooperation between Diesel engine manufacturer and accessory producer.

The American Bosch Type PSA Fuel Injection Pump is driven at crankshaft speed on 4-stroke-cycle engines. It is a pump of the cam-actuated constant-stroke throttled-intake type, the single plunger having a continuous rotary motion in addition to its reciprocating motion, thus serving as its own fuel distributor. Although a multi-outlet unit, it has only a single delivery valve. The PSA is equipped with a fuel supply pump (Fig. VI) of the positive-displacement gear type located at the side of the pump housing, and a variable-speed governor of the mechanical centrifugal type incorporated at the rear, driven directly off the end of the camshaft without gearing. Present production includes both the 4-cylinder type (PSA-4A) and 6-cylinder type (PSA-6A). Another series, the PSA-4B and PSA-6B of larger capacity, has also been developed for ultimate production.

Details of construction and operation can be described with special reference to the accompanying illustration of the 4-cylinder assembly, PSA-4A (Fig. II). The pump has a 3-bolt integral flange mounting using 5/16 in. o.d. bolts or studs for attachment to the engine. The drive gear furnished by the engine manufacturer is carried on the drive hub (8) which is keyed to the pump camshaft (5) through a straight involute spine.

The camshaft is of alloy iron, suitably hardened. It is supported at the drive end by ball bearing (7) which also serves to locate the camshaft axially in the pump housing. At the rear or governor end the camshaft is supported in a sleeve bearing (1) of the interchangeable type. The camshaft has an integral spur pinion which forms a shoulder for the drive end ball bearing and meshes with the face gear (6) to rotate it at one-half pump shaft speed. The face gear is supported in a flanged sleeve bearing in the gear housing (9). Proper backlash between face gear and camshaft pinion is obtained by dimensional control of parts without shimming.

Tappet (2) having external splines is situated within the mating splined bore of the face gear and rotates with it at half engine speed while being at the same time cam-reciprocated. A lower spring seat (4), having three driving lugs on its bottom face engaging corresponding holes in the tappet, rests upon the inside bottom surface of the tappet and is held against it by the two plunger return springs (10), or by one of these if the pump is not on a high-speed engine. The lower spring seat is rotated by the tappet and in turn rotates the plunger through plunger guide (3) which fits into the center slot of the spring seat and provides a self-aligning feature for the plunger stem. The plunger (11) is actuated on its upward or pumping stroke by the cam lobes and tappet. Plunger return on its downward reciprocating stroke is effected by the plunger springs through the lower spring seat and plunger guide.

The springs bear at their top against the upper spring seat (12) which abuts against a spring ring in the face gear.

It will be noted that the face gear with tappet, spring seats, springs, plunger guide and plunger rotate as one unit in phased relationship with the camshaft. The camshaft in the 4-cylinder pump, type PSA-4A, has two lobes 180° apart (see Fig. IV). Thus, with two revolutions of the camshaft necessary to produce one complete revolution of the face gear and plunger, there are four equally spaced pumping strokes during each plunger revolution. In the case of the 6-cylinder pump, PSA-6A, the camshaft is provided with three lobes spaced 120° apart in the same plane (see Fig. V) producing six equally spaced pumping strokes during each plunger revolution. The PSA-4A and PSA-6A are otherwise identical except for the number of outlet connections and necessary drilled ducts in the barrel head.

The upper or pumping end of the plunger is of

plain cylindrical form. The metering principle of the pump is that of throttled intake. The amount of fuel admitted to the barrel between plunger strokes is controlled by the positioning of throttle valve (21) in the fuel inlet duct. The fuel admitted is trapped when the plunger closes the port on its upward stroke, which closure occurs at a lift of approximately 3 mm or .118 in. off the base circle. Since the total stroke of the plunger is 5 mm or .197 in., a stroke of about 2 mm or .079 in. is available for injection. The plunger is moved these 2 mm in 30° of camshaft rotation.

Situated directly above the plunger and similarly lapped into the barrel is a displacer piston (20), the function of which is to provide a means for limiting the maximum fuel delivery of the pump with wide open throttle to any desired value. It is functionally equivalent to the control rack stop of an American Bosch Type APE or APF helix-metering pump. The displacer piston (20) is spring-loaded downward onto its seat, from which it is lifted by the hydraulic pressure in the barrel below it after the plunger reaches the port closing position of each upward stroke. Not until the displacer piston has been raised against its stop (17) can the hydraulic pressure in the barrel be increased sufficiently to open the delivery valve (15) and commence the effective portion of the plunger stroke. Adjustability of the position of the stop for the displacer piston, through its threads and lock nut (18), provides the means for varying the maximum quantity of fuel which the pump can deliver with wide open throttle. With the stop screwed down so far as to hold the displacer piston immobile on its seat, fuel delivery is at its maximum. When, however, the stop screw is backed off to lift it and permit movement of the displacer piston with each plunger stroke, the pump delivery is reduced by an amount equal to the displacement of the piston.

The single delivery valve (15) is situated laterally in the barrel (16) just above the topmost position of the plunger and on the side opposite the intake throttle. The valve, held against its seat by spring (14), is hydraulically lifted as a consequence of the plunger action. Fuel passing the delivery valve travels down the inclined duct to the lower horizontal duct (13) and thence to the upper and larger of the two annular cuts in the plunger, from which annulus rises a vertical groove (19) in the plunger. Continuous rotation of the plunger by the face gear at one-half pump camshaft speed permits the vertical groove in the plunger to serve as a distributor, communicating on successive working strokes with each of the outlet ducts from the barrel, which ducts are disposed radially in a horizontal plane and spaced 90° apart for the 4-cylinder and 60° apart for the 6-cylinder execution. The plunger's rotating and reciprocating motions are so phased in relation to the outlet ducts that the vertical groove in the plunger overlaps one duct during the effective portion of each stroke. Thus, with each complete revolution of the plunger hydraulic communication is successively made with the four discharge connections in the 4-cylinder pump or in the case of the 6-cylinder pump, six discharge connections.

Certain applications of Diesel injection pumps make desirable a fuel delivery characteristic, as a function of speed, at least roughly proportional to the ability of the engine to burn fuel, or in other words roughly proportional to the engine's inherent torque characteristic. Some engine builders desire the crest of the torque curve to occur at, say, 60% of the full load speed, which means that the fuel quantity per stroke must be greatest at that 60% speed. There is a tendency of the PSA Pump at partial throttle to increase its fuel delivery with decrease in speed because of the longer time available for barrel filling. This contributes in a general way to the desired torque effect while also promoting a stability which materially assists the governor. But at wide open throttle the pump tends to increase its delivery with increase of speed (or decrease its delivery with decrease of speed) precisely as does any ported pump whose barrel is filled each stroke. It is therefore necessary in the PSA Pump to achieve the desired maximum torque characteristic through suitable use of a retraction-volume piston on the delivery valve. The volume of this piston, which serves also to provide a varying degree of pressure relief between injections, is chosen in conformance with the amount of droop in capacity which is required with increase in speed on a given engine. A controlled flow area is produced on the piston so that the effective relief action obtained will vary with the speed of the pump and the lift of the valve. With increase of speed in the normal operating range the delivery valve lift increases, its retraction-volume piston becomes more effective, and a greater amount of fuel is required each stroke for restoration of pressure in the discharge line. The result is a decrease in the net quantity of fuel received by the nozzle with increase in speed, and hence an increase of quantity with decrease of speed, as desired.

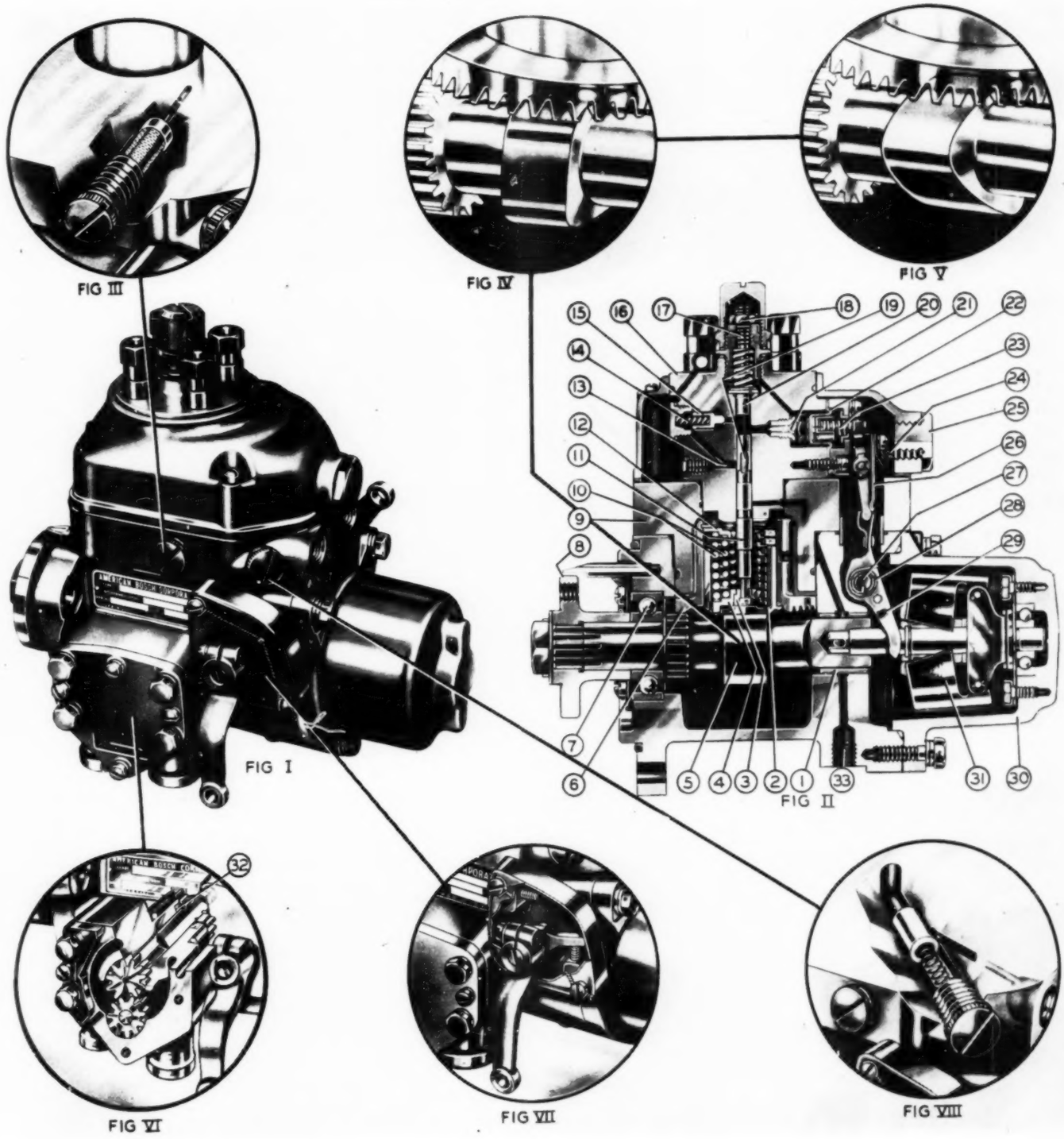
The fuel supply system feeding the throttle valve has as its major component the supply pump (Fig. VI) of the positive-displacement gear type and driven by the face gear. A shaft seal (32) is provided to seal the fuel system from the lubricating system. Located on the side of the PSA Pump, under the name plate, the supply pump draws fuel from the storage tank and delivers it, through suitable filters, to the fuel inlet connection of the injection pump at the rear of the gear housing. A horizontal duct in the gear housing channels the fuel onward to a point under the barrel whence it flows upward through a passage in the barrel into the sump which houses the throttle valve. Surplus or bypassed fuel from this sump flows downward through another passage to the overflow valve (Fig. VIII) where it acts against the valve spring. The flow capacity of the valve is such that close pressure regulation is possible. From this valve the bypassed fuel is returned to the storage tank from the outlet at the rear of the gear housing. The direction of the fuel flow through the supply pump is dependent upon pump rotation; the two fuel connections may, therefore, be either inlet or outlet. It is also possible to reverse at will the inlet and outlet connections on the gear housing, but only by proper location of the overflow valve which must at all times be adjacent to the outlet.

The variable-speed governor of the mechanical centrifugal type (30) is driven directly off the rear of the camshaft as shown in Fig. II. A counterbore in the camshaft carries the governor shaft-end which is slotted to straddle a driving pin pressed into the camshaft diametrically. The other end of the governor shaft rotates in a ball bearing. The governor lever assembly (29) is pivotally supported on the operating shaft (27) and there is a torsion spring (28), coaxially mounted on the operating shaft, which straddles the governor lever assembly. Centrifugal throw-out of the governor weights (31) shifts axially the position of a sleeve on the governor shaft. This sleeve abuts against the governor lever assembly which in turn actuates the throttle valve to move it towards its shut-off position. The centrifugal force on the governor weights required to accomplish this, and therefore the rotative speed, are functions of the setting of the operating lever (Fig. VII), because this lever is clamped to the operating shaft.

The operating lever winds up the torsion spring when it is moved towards its full speed position, and the spring reacts on the governor lever assembly tending to move it, against the force applied by the sleeve on the governor shaft, in that direction which opens the throttle valve. The position of the operating lever, therefore, determines the spring force which must be offset by governor force before governing takes place. Fig. VII also shows the speed adjusting stop which is clamped to the operating shaft and provides in cooperation with the two stop screws minimum and maximum adjustments at the extreme positions of operating lever travel. A sheet metal cover forms the closure of this assembly and is lock-wired after adjustment is made as a tamper-proof feature.

An idle adjustment is provided by the leaf spring adjusting screw (24), (see Fig. II). This screw is accessible when inspection plug (25) is removed. Leaf spring (26) comes into play just before complete closure of the throttle valve and can be adjusted by the screw so that its force will just balance the governor effect at the desired low-idle speed. Shut-off control is provided by a lever located on the opposite side of the pump from the operating lever. By moving the shut-off lever towards the governor end of the pump, a small plate cam is forced against the governor lever assembly, effectively closing the throttle.

Free axial movement of the throttle valve is obtained by the use of a flexible diaphragm (22) which is clamped at its center on the valve stem and at its periphery between the throttle valve



cover assembly and barrel. Since the diaphragm forms a closure for the fuel sump, it is acted upon by the fuel supply pressure. To offset this unbalancing force, throttle valve spring (23) is mounted on the outer side of the diaphragm.

The PSA Pump is designed to receive pressure lubrication from the lubricating oil system of the engine to which it is applied. Oil under pressure (10-60 psi.) can be supplied either through the face of the mounting flange, by suitable location of ducts in the engine and pump structures, or through an external tubing to the ⅛ in. pipe tap connection at the underside of the pump. From this latter connection (33), the lubricating oil passes upward to the camshaft bushing, around a groove in the bushing bore, then in part upward to the face gear housing, and through its ducts to the face gear bushing and tappet. A certain amount of lubricating oil enters the spring compartment formed by the tappet and face gear, where it is thrown through holes in the tappet face during operating and sweeps desirably across the face of the cam.

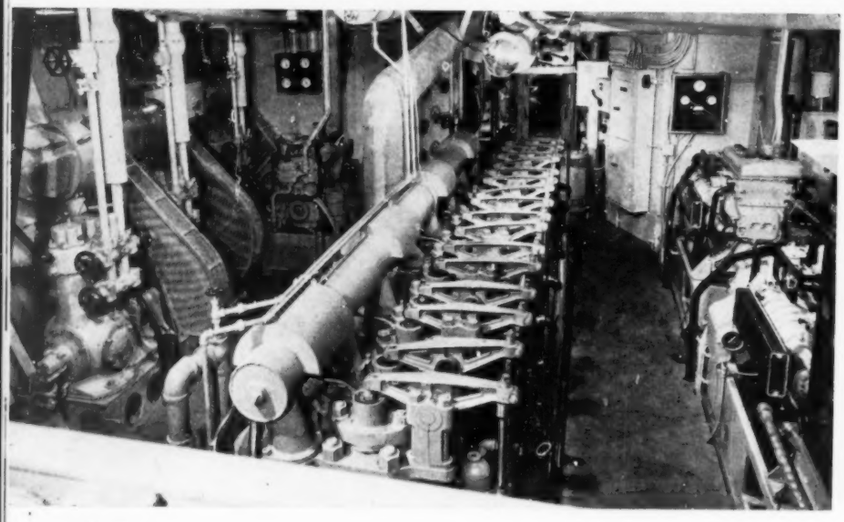
The Type PSA Single-Plunger Pump in its initial or "A" size is intended to be comparable in capacity with the type APE multi-plunger helix-controlled pump of the "A" size. This means that the PSA..A is designed for normally-aspirated 4-stroke-cycle engines of piston displacement up to approximately 80 cu. in. per cylinder or for fuel quantities up to about 90 cu. mm. per stroke.

Defiance

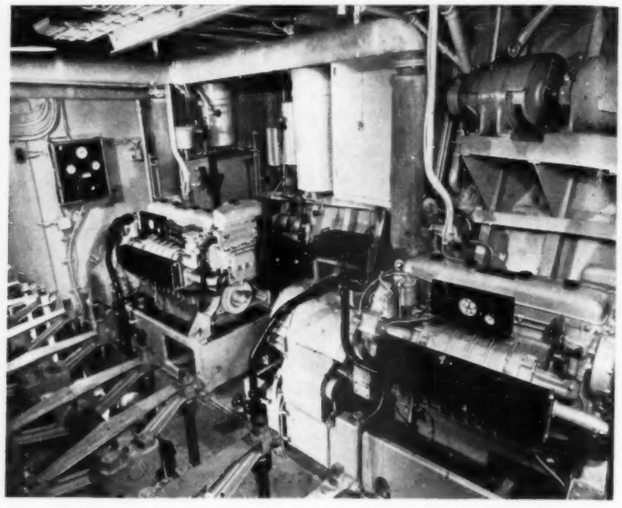
Tacoma-built Tuna Seiner

By CHARLES F. A. MANN

Defiance engine room looking aft with 600 600 hp. Washington Diesel, center.



Engine room, port side, has two 100 hp General Motors 6-71 Diesels supply auxiliary power.

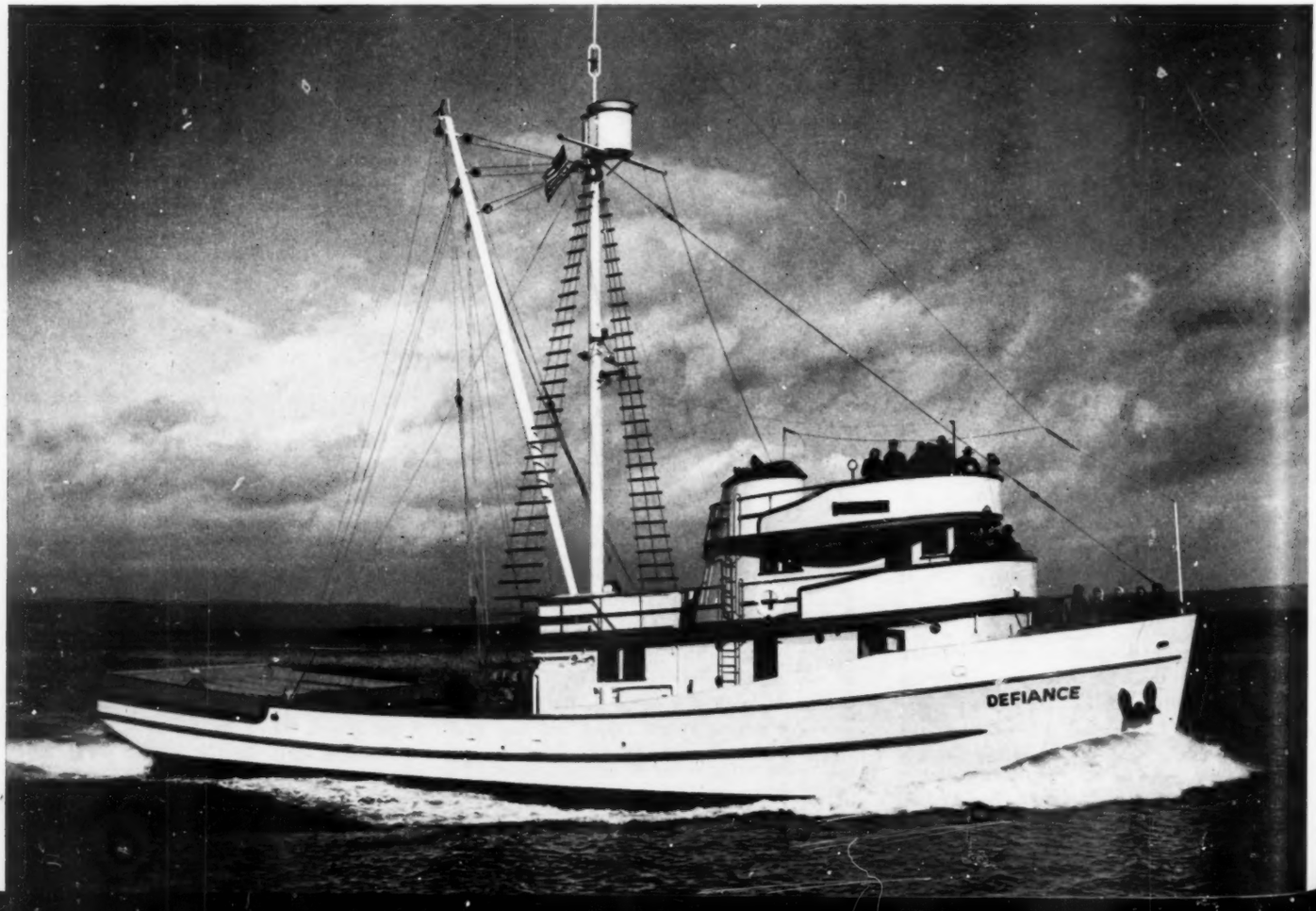


THE first large postwar fishing vessel from the big plant of Tacoma Boat Building Co., Inc., at Tacoma, newest in a line of nearly 120 new commercial vessels and 1050 repair, conversion, and rebuilding jobs turned out by this yard, is the trim all-welded steel Diesel tuna seiner *Defiance* which arrived at her home base in San Pedro, California, March 7.

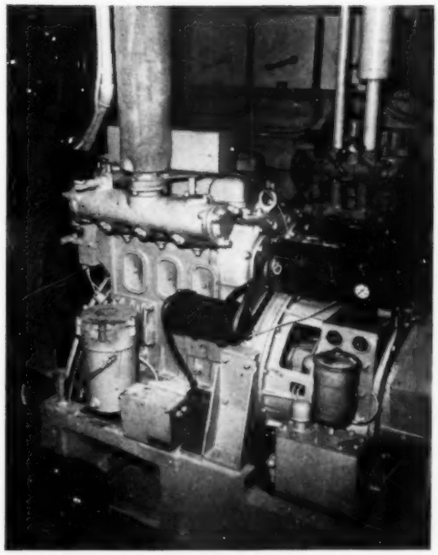
Defiance is not a tuna clipper—it is a tuna seiner. Newsreels and press wire services please note the difference! (Our DIESEL PROGRESS readership includes practically all of the fact-hunting and distributing sources in the country, if you please). If we err, they all do.

The sleek 106.8 x 26.7 x 14 ft. vessel is large by the standards of seiner type ships, and she features

Tuna seiner, *Defiance*, on her trial run. She is 106 feet long with a beam of 26 feet.



Two views of 3-cylinder General Motors conversion Diesel and Twin Disc torque converter which drives seine winch.



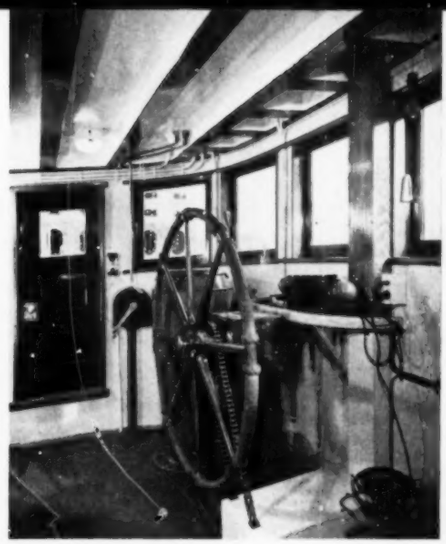
a gigantic purse seine driven by a 55 hp. 3 cylinder Detroit Diesel-driven Northern seiner winch, via Twin-Disc hydraulic torque converter drive with remote controls on deck, the like of which has not been seen heretofore. When we use the term "driven" we really mean "hauled" for manipulating a 2500 foot long, $15,000 seine, when filled with several tons of the smaller, but live-wire species of tuna that lend themselves to being caught better with a seine than with baited hooks, requires power in large proportions.

The Northern Diesel driven winch is a complicated assortment of variable speed drums and gypsies. Five drums and 3 gypsies are driven and clutched from one compact assembled unit, with fingertip control of power and the various drums. The hydraulic drive with a Diesel that will go down to almost a complete stall without actually stopping has, startlingly, proved cheaper and more efficient than the finest of motor drives. Tacoma Boat has again pioneered with another use for Diesels. The Diesel is the 71 Series, small and compact, with its own accessories and auxiliaries and leectric starter. It drives directly into the hydraulic drive and then through a reduction drive to a chain and sprocket drive that carries the power to a short jackshaft mounted under the deck beams. Fafnir roller bearings are used on this jackshaft, the other end of which feeds the Northern seiner winch mounted aft of the deckhouse, through bevel gearing and additional short shafting. Control panel is mounted beside the winch on the deck, so the operator controls the Diesel drive below decks while yanking his purse cable and hauling the net full of fish to the side of the ship for brailing and restacking on the huge square net turntable that occupies almost the same area as the floor of a sizeable garage and may be turned in a full circle, fully loaded, by two men.

Defiance is featured by carefully designed and executed procedure common to pre-war fishing craft, rather than a speedup war time procedure where haste apparently paid off instead of quality. A syndicate headed by Captain Ted Lucich of San Pedro, Cal. (Los Angeles) operates the vessel for South Coast Fisheries. The hull is entirely of welded steel and carries a double bottom with capacity of 5700 gallons of fuel oil. Welded tubular steel mast and boom is fitted also. The deckhouse and pilot house is of waterproof plywood construction, trimmed in light and dark hardwood panelling and moulding. Hotel like accommodation for the crew features the large crew's quarters with spring berths, private clothes lockers, reading lamps, forced air ventilation, individual portholes, 3-piece bathroom with fresh water; Magnesite floor cover, P.A. system to pilot house, etc. The large galley features a large walk-in storage refrigerator and a hotel size mechanical refrigerator, tiled and stainless steel sink, oil range and electric hot water system, besides crew's radio for program reception, fans, etc.

Gone is the machinery flat on the main deck, with its vibration, dirt and noise. Every bit of machinery is packed neatly into a single spacious machinery compartment, with plenty of room to walk around. The practice of having condensers and ammonia pumps and one or two Diesels on the main deck in a machinery flat is gone in this ship. So is the smell of leaking ammonia. The condensers are flat-type mounted each side of the deck house far aft.

Tank capacities for a voyage to South America are provided. In addition to the double bottom, there are two tanks in the engine room, holding 3600 gallons of fuel; 2 forepeak tanks for 4500 gallons and 2 stern tanks for 3600 gallons, plus brine tanks 1 and 2 being piped for fuel oil storage up to 12,000 gallons to be used on the outbound voyage. Fresh water amounting to 3400 gallons is carried in 3 stern tanks, and there is an



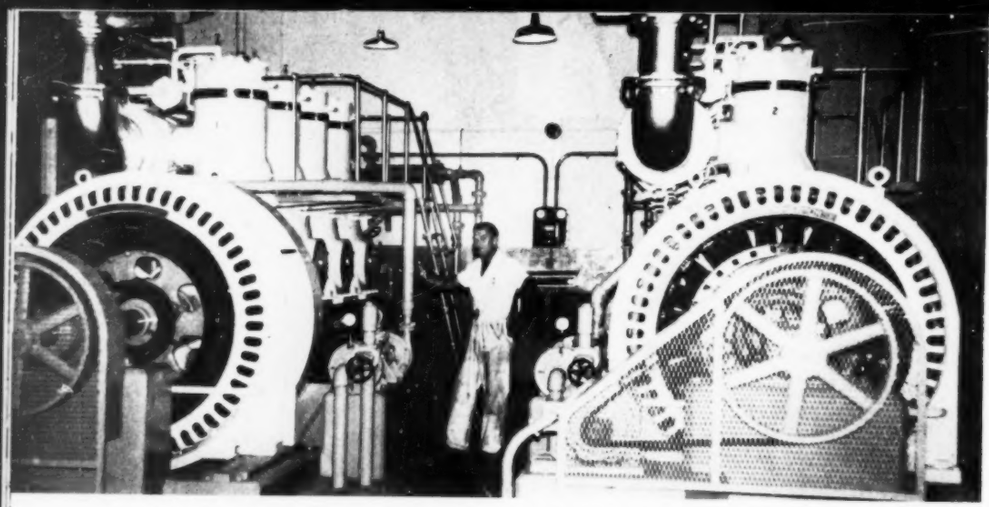
Pilot house view of *Defiance* showing Sperry steering stand and Gyro-compass.

Allen (Seattle) copper tube water still compactly mounted in the amazing engine room to eliminate having to use valuable buoyancy for carrying fresh water.

There are 6 brine tanks for carrying frozen fish with a capacity of 225 tons maximum, cork and emulsion insulated, welded steel construction, and welded galvanized ammonia coils. These tanks face the shaft alley-pump room, where a battery of 10 Jacuzzi (Barco Motors) pumps are fitted for brine circulation. The tailshaft is rubber covered and the stern bearing is Cutless rubber. Removable floor panels in the shaft alley give access to the shaft bearings, etc. Two watertight bulkheads separate the engine room from the rest of the ship.

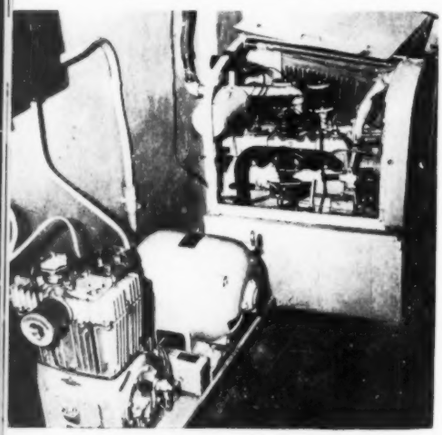
Main propulsion is an 8 cylinder 14½ x 18 Washington Diesel developing 600 hp. at 277 rpm. Coolidge propeller and steel plate rudder is fitted. All fittings are set up to eliminate electrolysis as much as possible. Auxiliary electric power is provided by 2 identical GM conversion 6-71 Diesels, developing 100 hp. each and driving 60 kw. 110 volt D.C. Delco generators. A third Diesel, the little 3-cylinder GM 55 hp. conversion drives the Twin Disc seine winch shafting. Mounted on the starboard engine room skin of the ship are three 8 A Baker ice machines, with cylinders 5½ x 5½ in. and powered with 20 hp. G.E. motors. A 7½ hp. DeVilbiss auxiliary air compressor, 2 air bottles, a switchboard, plus the water still, 2 fuel tanks and a lube oil tank complete the comprehensive engine room layout. Sperry electric steering gear, with metal marine pilot is fitted, as well as 2 general service Fairbanks-Morse pumps. A MacDonald fresh water system is fitted. A 7½ hp. F-M and a small 2 hp. self priming fuel pump is also installed.

The pilot house adjoins the master's chart room compartment, with a world-range Hallicrafter radio, full bathroom, desk, chart table, etc. Pilot house controls for the main Diesel, which also extend to the "outdoor" pilot house atop the roof make for easy control.



Fuchs Bakery confounded power line wrecking tropical storms by installing Fairbanks-Morse Diesels —two 300 hp. 2-cycle jobs. Note Maxim silencers and Alnor pyrometer (rear center).

Auxiliary air compressor by Quincy (left) supplements Ingersoll-Rand for air supply.



Plant engineer and maintenance manager Neil Jeffrey operates valve for Ross heat exchanger.

DIESELS FOR

South Florida wholesale bakery tools up with Diesel to avoid power failures

LAST September, when fringe winds of a "tropical storm" (hurricane" to everybody but local chambers of commerce) hit Southeastern Florida, *all but one large-scale bakery* had to suspend baking operations due to a general powering failure on the part of the local utiilty. The one exception—Fuchs Baking Company of South Miami —went right on producing, because it had its own Diesel-engine-provided power source.

Because of its geographic location, all industrial powering in South Florida poses a rather special problem. The two most practical power sources in this area are electrical current and steam produced by fuel oil. And, of these two—due to climatic conditions—electrical current is the more commonly employed.

Electrical powering has proven perfectly practical for any kind of industry, which is, itself, practical for South Florida but—now here comes the "joker": utility-supplied current is storm-vulnerable in Southern Florida. Any wind of 40-miles-per-hour velocity or more knocks out the local utility's transmission lines. Not too infrequently a heavy rain will do it. And here's the reason: due, largely to the area's rapid growth—it's spread out like a barrel of lube oil on a body of water—the utility's transmission lines, except for a limited area of Miami's downtown business section, are pole mounted. Comes a gale, and, Bingo! no power. no business.

Moreover, Fuchs Baking had (or did have) a powering problem of its own. Baking bread to supply a large part of the demand for that product in a territory extending from Fort Lauderdale, Fla., to Key West is quite a chore. The firm supplies most of the hotel dining rooms, restaurants, lunch rooms and hot dog and barbecue stands, plus practically all grocery stores, in the territory named, with bread of several kinds, hot dog rolls and hamburger buns.

To do this, the company, currently, is baking, around the clock, 3,500 loaves of bread per hour, plus other bread products (buns and rolls). A $900,000 addition to the plant, now, in process of equipment, will step up production to 8,000 to 10,000 loaves per hour, when in operation. Referred to by plant personnel as the "new" plant, the added faciilties will be almost automatic in their functioning.

Since a modern baking plant is a highly mechanized affair, Fuchs Baking powering-needs run into a lot of wattage. The "old" plant's powering requirements cover, approximately, 85 electrical motors ranging from a fraction to 40 hp. And 60 more, ranging from 1¼ to 50 hp., will be required to motivate the added machinery. The "demand load," then, will be 275 to 300 kw.

Understandably, neither the company nor its customers likes to see bread production interrupted by a power failure. Therefore, plan technicians pooled their collective ingenuity and technical skill to make operation as "trouble free," as possible.

Several months previous to South Florida's annual "storm season," Fuchs Baking installed two Fairbanks, Morse & Co. Model 32-E-14, 300 hp., 2 cycle, 4 cyl., Diesel engines. Operating at 300 rpm., each of these engines is direct-connected to a F-M type TGZO generator. The latter and its mate have a combined output of about 400 kw.

Having a 14 in. bore and a 17 in. stroke, these Diesel engines have a concrete base (50 yds. of concrete) which is vibration isolated by a ½ in. expansion joint of compressible material. And the engines are water cooled and compressed-air started. Later described, cooling water and compressed air sources are duplicated to provide maximum "trouble free" operation.

Exhaust gases pass through Maxim silencers to above-the-roof stacks. Because of local climatic conditions, the stacks are provided with homemade sheet metal covers. Hinged, these automatically are opened by exhaust-gas pressure, when engines begin to operate. Manually closed, at other times, by attached cords with weighted ends above the engines, the hoods keep out rain, which, otherwise, would get into the silencers, and eventually into the exhaust manifolds and cylinders.

Gravity-fed from an outside, above-ground storage age tank of 20,000 gal. capacity, fuel oil for the engines and the plant's other oil-burning equipment, such as baking ovens and steam generators, is Belcher No. 2 grade. For Diesel engine use, it is screened by Buffalo Meter Company filters. Fuel oil consumption is 8.66 gals. per 100 kwhr.

Fed through visible lubricators, standard DTE

EMERGENCY POWER

By HARRIE H. BIERMAN

(SAE 30) lube oil is screened through Purolator type G-48-34 filters.

In the compressor setup, there is a double provision against trouble in engine starting. The regular compressor installation consists of an Ingersoll-Rand type 30, 2 cyl. compressor powered by a Westinghouse type CSP, 5 hp., 220 v., motor, operating at 1460 rpm., and a Quincy 2 cyl. compressor, powered by a Crocker-Wheeler 10 hp. 220 v., 3 phase, type SC motor, operating at 1735 rpm. The Ingersoll-Rand compressor provides air for engine starting, while the Quincy compressor supplies air for plant use—various machinery cleaning-operations—and for the company's truck-maintenance shop. Air is stored in 4 Morison Bros. 250 lb. tanks, having 9/32 in. steel shells.

When both compressors are functioning, each serves 2 tanks. However, tanks and compressors are so hooked up that either compressor can serve all 4 storage tanks. And, in addition, there is a third (and "emergency") compressor. This is a Smith conversion of a Ford Model A, automotive engine. In this conversion, two of the Ford's cylinders function as a gasoline engine to power the other two, which serve as a compressor.

Water for engine cooling comes from 3 sources: (1) City water main (2) an 8 in. driven well (3) two 6 in. driven wells. The last named were sunk, when the Diesels were installed, and are just outside the building housing the engine room.

Water from these to wells—one for each engine—which are 60 ft. deep, reaches a normal maximum of 50 to 60 lbs. pumped pressure. The well water is drawn, and the jacket water is circulated through the engine, by two F-M pumps attached to each engine, just back of the flywheel. One pump draws water from the well, while the other pump serves the engine's water-circulating system.

Each pump is driven by a V-belt running over a 6 in. and a 24 in. pulley. Two types of V-belts are, currently, being tried out—a Gates and a Veelos—one of each on each engine. The Veelos is a link-type belt.

Well or "raw" water—that is, water not treated to eliminate scale-forming content—is not admitted to the engine cooling system. Its sole function is to cool circulatory water. Water from both sources—the wells and the engine water-jacketing—goes to a Ross heat exchanger.

The jacketing water passes through the exchanger tubes, while the well water flows around them. Since the chief purpose of the Diesel installation is for "emergency" powering, no provision has been made to make use of engine-heated water. That from the wells, after serving its cooling function, passs to an outside drain.

Water for the engine jacketing comes, normally, from the city pipes, and is treated to eliminate scale-forming minerals. If this source should fail, there is another water auxiliary. On either side of the engine room, there is a 50 gal. tank, mounted on a raised platform. These tanks can be supplied from either city pipes or the plant's main auxiilary (later described). Water from the tanks is always ready to keep engine water-jackets filled. It can be used, also, to prime the two well pumps mentioned, should that be necessary.

Water pressure gauges at the engines are U. S. and J. P. Marsh. Water pumping equipment for the two engines is identical. The platform-mounted tanks have sight-type gauges—a floating, black, cork ball, visible from the engine-room floor. Piping controlled by a manually-operated valve can by-pass part of the well water around the heat exchanger, if jacket-water shows too much temperature-drop, thus providing efficient temperature control under all conditions.

The city water supply, itself, comes from a system of driven wells, and is pumped to supply lines by electrical pumps, powered by the utility. Therefore, when the latter has a power failure in the well fields, there is no water. Thus, the need for an auxiliary water supply is obvious.

Fuchs Bakery's *main* water auxiliary is an 8 in. driven well, which has been in operation for several years. Besides use of the water as an alternative cooling medium and for pump priming, it is employed, also, for general plant use—washing plant floors and equipment, truck washing, employe wash rooms, toilets, showers and the like. It can be used, in the case of a city-water failure, for the plant's steam generators.

Water from the 8 in. well is drawn by a Norwood centrifugal pump, powered by a 7½ hp. 3-phase, 220 volt electrical motor of the same manufacture, and is stored in a 750 gal. tank at the opposite end of the engine room from the Diesels.

At the time of the writer's visit to the Fuchs plant, the need for an auxiliary water-supply source was made obvious. Jeffery was explaining the system, when he glanced at a gauge from force of habit. "Look!" he said. The gauge read "0." "That's the city water pressure," he remarked. Jeffery turned a couple of valves, flipped a switch and another gauge read "50 lbs." That was the pressure gauge for the well-supplied water. Ten minutes later, the city water gauge read "50 lbs." In this case, there was no general power failure, and the cause for the shut-down was unknown.

Steam is essential to certain baking processes. That used in this plant is provided by two identical Cleaver-Brooks Model OB7, oil-burning, 70 hp. low-pressure steam generators. Since local water has a high scale-forming content, it is first treated for the elimination of the later by a Permutit Model #5 SPSDT treatment unit. Thence, the treated water goes to a Cleaver-Brooks preheating boiler, before going to the generators.

Current from the Diesel-powered generators go to a Westinghouse, deadfront, 220 volt, 600 amp., instruemnt panel. For each generating unit, this panel is equipped with a voltmeter, frequency meter, kilowatt-hour meter, power factor meter, line ammeter, exciter ammeter and kilowatt meter. To parallel electrical output, when powering is sitched from one Diesel to the other, the panel is provided, also, with a synchroscope. Voltage variations are automatically corrected by a Westinghouse Silverstat for each generator.

The generators' Fairbanks-Morse type DG exciters, operating at 1750 rpm., are belt-driven by six Gates V-belts over 6 in. and 33 in. pulleys.

Conditioned for plant use, the current from the instrument panel goes to a Frank Adams main distribution board. This handles and distributes the current from either the utility or the Diesel engine source. And it is at this board that the change-over from one source to the other is made. The shift is effected by opening the panel, which automatically cuts off the current, and turning two switches—a matter of less than 30 seconds.

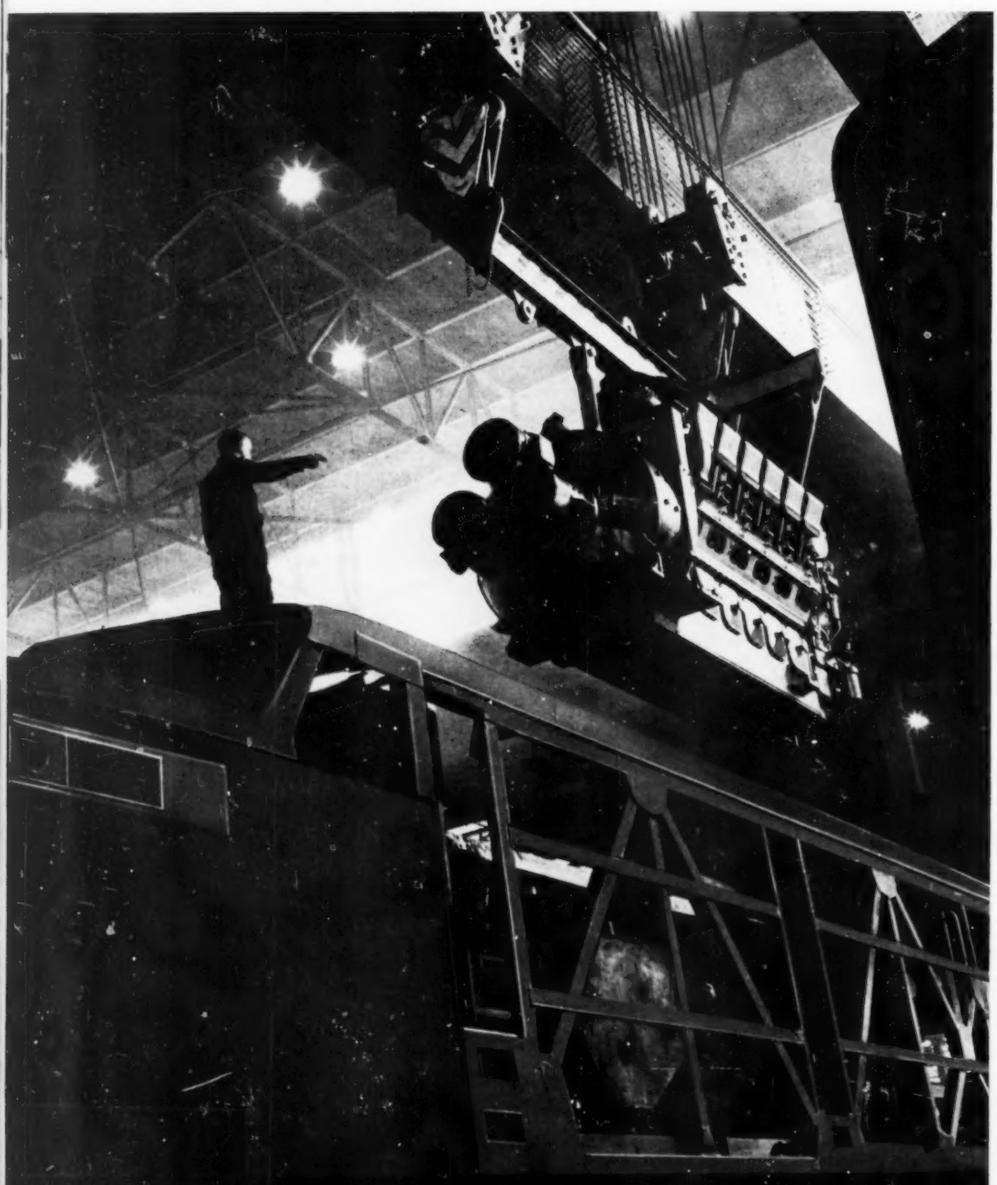
While the current produced by the Diesel-powered generators is of 220-volt, 3-phase, 3-wire type, and most of the equipment (as will be noted) is adapted to that type of current, a G.E. auto-transformer cuts it to 110-volt, single phase for lighting and for the use of certain kinds of equipment.

Now, that the firm has more than enough electrical output from its Diesel-powered generators to supply its present and near-future powering needs, it is planning a use, other than "standby," for this equipment this coming winter. During the winter "season," there are times, when the utility's facilities are (or have been) subject to an over-demand. Usually, this peak demand comes during the early evening hours. So, Fuchs Baking is planning to relieve the general powering situation by operating its Diesel engines for plant powering, between 5 and 9 P.M.

The company is planning, too, to expand its water-treatment facilities, so that it may use more of its self-produced water for various plant purposes.

RAILROAD EXECUTIVES CONFERENCE

Dramatic view of Alco-G.E. locomotive assembly operation. Diesel engine being lowered into position by traveling crane. (Above) Robert B. McColl, President, American Locomotive Company, who addressed railroad executives at Schenectady, New York, recently.



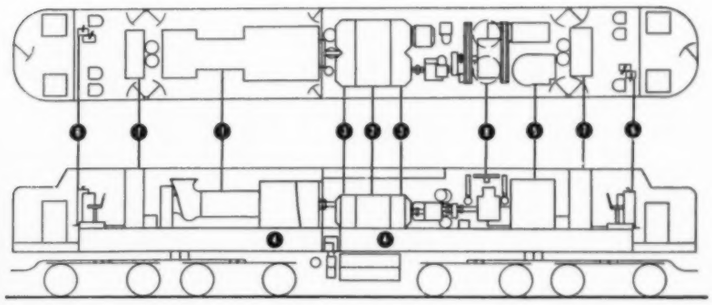
EARLY in March technical and executive railroad representatives gathered in Schenectady, New York, for a conference which was highlighted by the exhibit of a developmental locomotive gas turbine and huge 6000 horsepower Diesel-electric locomotives, a demonstration of the latest developments in the field of railroad motive power.

Sponsored jointly by the General Electric Company and the American Locomotive Company, the Railroad Executives' Conference included the demonstration of a G-E gas turbine which is being developed for possible railroad and other applications, and a tour of the Diesel-electric manufacturing areas in the Alco plant.

Charles E. Wilson, president of General Electric, and Robert B. McColl, president of American Locomotive, in addresses stressed that the Diesel-electric is today's outstanding locomotive power plant, and that it would continue in that capacity for the foreseeable future. They pointed out that the two companies are advancing their efforts in Diesel-electric design, engineering, and construction. G.E. is pioneering in gas turbine research and development.

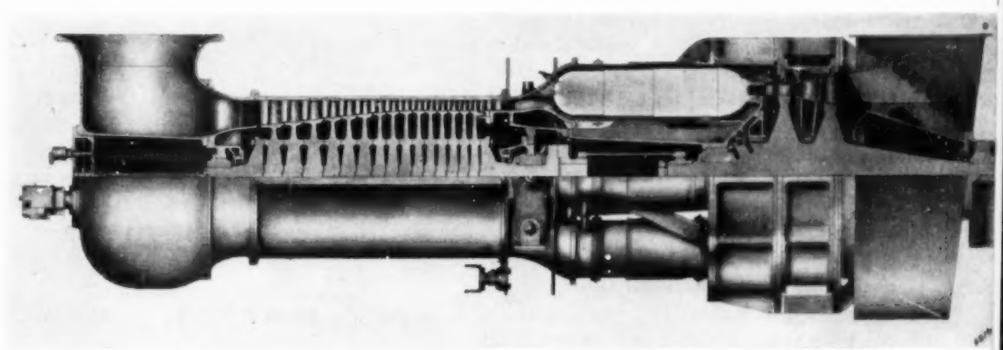
G. W. Wilson, manager of General Electric's Locomotive and Car Equipment Divisions, told the railroad executives that his company had spent four years of development work on the gas-turbine power plant.

"Initial performance of this developmental unit is promising," he said, pointing out that it had been operated in factory tests almost continuously since September, 1947. "However, the potentialities of a new prime mover can be truly evaluated only after exhaustive tests in the factory and on the rails," he said.

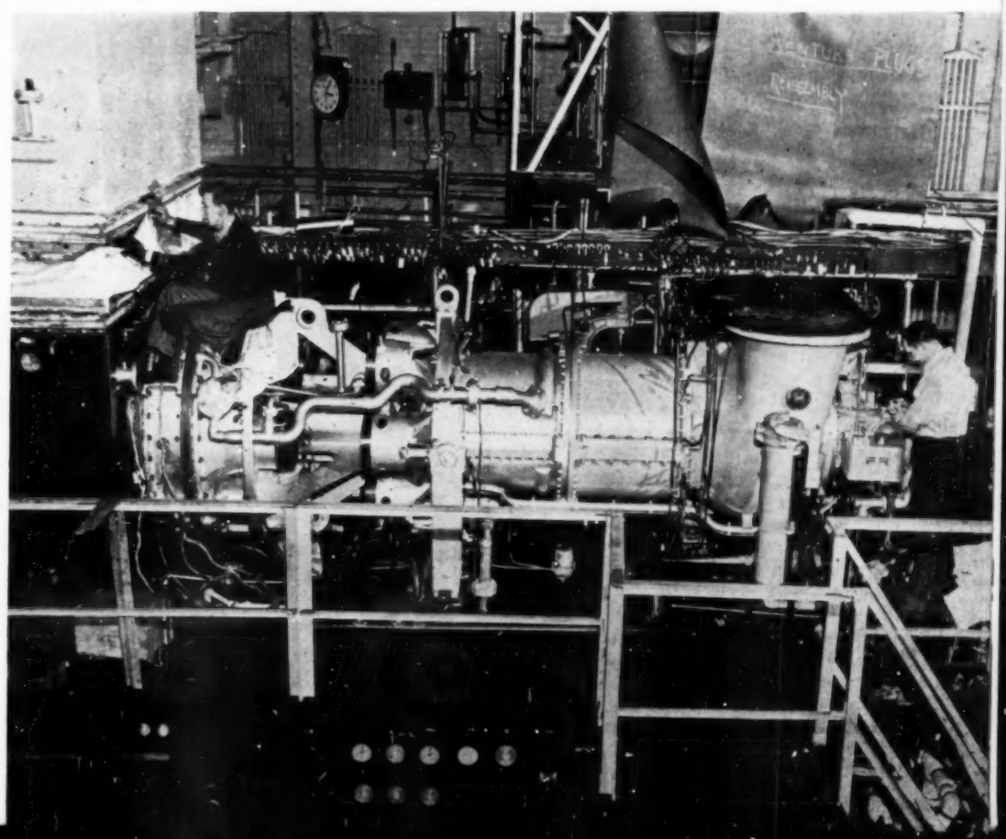


Proposed layout of machinery for gas turbine locomotive. (Left) Charles E. Wilson, president, General Electric Company, who spoke at recent conference.

General-Electric locomotive gas turbine showing longitudinal semisection of turbine blading.



G.E. developmental gas turbine on test stand. It is rated at 4800 hp.



The American Locomotive Company has built more than 75,000 locomotives—more than any other company—since its inception, Mr. McColl said. In 1946 Alco's production was 75 per cent steam locomotives and 25 per cent Diesel-electrics; this has changed to an estimated 92 per cent Diesel-electric production and 8 per cent steam in 1948. Mr. McColl pointed out there are 35,000 steam locomotives on the American railroads today, and that it is estimated they will be replaced by 20,000 Diesel-electrics in the next decade. Alco announced a comprehensive Alco-G-E spare parts and service program, which has been set up to maintain the availability record of the Alco-G.E. locomotives. "General Electric has been a leader in the application of electric equipment for every purpose in the railroad industry for more than 50 years," according to G. W. Wilson. "To maintain this leadership, we must make available to the railroads the latest developments in our field of activity. It is natural, therefore, that we should be testing application to railroading of the phenomenal advances made in the steam and gas turbines."

Nineteen feet long, and weighing 19,000 pounds, the locomotive gas turbine as presently conceived could be installed in one unit, according to Alan Howard, General Electric gas-turbine engineer, who described technical features of the unit.

In the developmental gas turbine, Bunker "C" fuel, a low-grade fuel oil, is burned in six all-metal combustion chambers, and it was said that the same unit can be adapted for the use of pulverized coal as fuel. Much of the engineering and manufacturing experience acquired in connection with the company's aircraft gas-turbine developments has been taken advantage of in producing the locomotive gas turbine.

Diesels Take Over No. 2 Shovel Job

By F. HAL HIGGINS

EITHER the man on the No. 2 shovel job has priced himself out of that labor market, or he has been automatically boosted to a higher scale of living standard with a fatter pay envelope. Time will tell one of these days when we finally come down from the post-war plateau. Anyway, you have to hunt for the traditional man with the hand shovel on a contractor's dirt-moving, ditch-digging or home construction job. If and when you do locate such a man he will likely be found all alone and leaning dreamily on the shovel as he watches the Diesel-engined tractor neatly shovel up and toss into a waiting truck the dirt he used to handle at rates varying from $1 a day on up to that much and more per hour.

At this $1 to $1.50 an hour point in wages, a skilled operator rolled into the picture and began taking over. There are hundreds of Caterpillar, International, Allis-Chalmers and Oliver crawlers equipped with Traxcavator, Bucyrus-Erie, and a dozen lesser known makes of front-scoop and lift attachments at work on the West Coast. The number grows by leaps and bounds from day to day and month to month under the home, industrial and Governmental demands for more new construction of buildings, roads, streets, bridges, etc. The amazing thing to note is the skill of the operators, who not only save enough to pay for tractor, attachment and their better wages than any hand shovel man could get, but they do a better job. There is nothing in the way of maneuverability, cutting and scooping that they can't do, apparently. As one contractor put it, a good front-lift tractor operator can shave you if you want that job done while he is here.

There are several little contractors in the San Francisco Bay area who specialize on this special front-lift tractor work. A big contractor with a multi-million dollar building to put up will call up one of these front-lift tractor contractors and order a tractor for a certain job on a certain day and hour. A truck rolls up to the job, drops off the tractor as an operator drives up and climbs on to do his stuff. It may be down in the basement excavating for an elevator shaft for the building, or it may be a job of excavating old logs or foundations from the old building being replaced. These tractor boys are as skilled as the Cat skinners we used to marvel at in the logging camps 20 years ago when they were looked upon as the top in the "Cat skinning" calling.

Your Old Reporter likes to study these trends as he notes them beginning to bud under his eyes as he drives around over the West. It was quite apparent a year and more ago, that here was something beginning to happen to give the Diesel tractor another job with more skilled operators earning good money while the old hand labor disappeared into retirement or stepped up to a higher level of pay and machine operation. So, he began stopping his car, getting out with camera Caterpilla. D2s and D4s, International TD 9's and and pencil and asking questions when be saw Allis-Chalmers Hd 7's being operated on home building jobs in Berkeley a year ago. Some of these tractors did only three or four hours work at excavating a foundation and side walk. They were loaded onto a truck and rushed from one job to the next.

"How can you afford to own and operate this International Td9 with Bucyrus-Erie front-lift shovel?" the writer quizzed a contractor building a church on Grand Avenue in Oakland, a few weeks ago. He had seen the tractor scooping out foundations and piling the dirt in the lot as he passed several times. "At $1.50 an hour, I can't afford to hire hand labor to excavate with No. 2 shovels," he replied. "This tractor will do more and better work than 50 of those fellows would do—if I could get them. And they would be in each other's way here if they tried to really work in excavating the foundations and throwing the dirt on the trucks, or wheeling it in barrows over to the pile of dirt in the middle there. No, this tractor is paying for itself on this job, and it doesn't require wages when not working on account of weather or waiting for the next job. The Diesel tractor is a necessary building construction tool for a contractor these days. And it's here to stay."

Digging foundation for new church in Oakland, California. Diesel saves time and money for parishioners.

Here International Diesel cuts foundation trenches and piles soil for later use as fill.

International Diesel loads truck off a California highway. Wheel tractors still have wide popularity.

International Diesel with Southwest front lift scoop digging up old pavement in Napa, California. Shovel experts at right.

Another view of International Diesel working on Oakland church site.

JOHN W. OHL . . .

12" SUCTION TYPE

HYDRAULIC DREDGE

By GEORGE D. CROSSLEY

THE Marine Division of the Maxon Construction Company, Inc., of Tell City, Indiana, recently designed, constructed and delivered to the Koch Sand & Gravel Company of Evansville, Indiana, a new all Diesel electric powered hydraulic dredge. This dredge was named the *John W. Ohl* for John W. Ohl, Operating Superintendent of Koch Sand & Gravel Company.

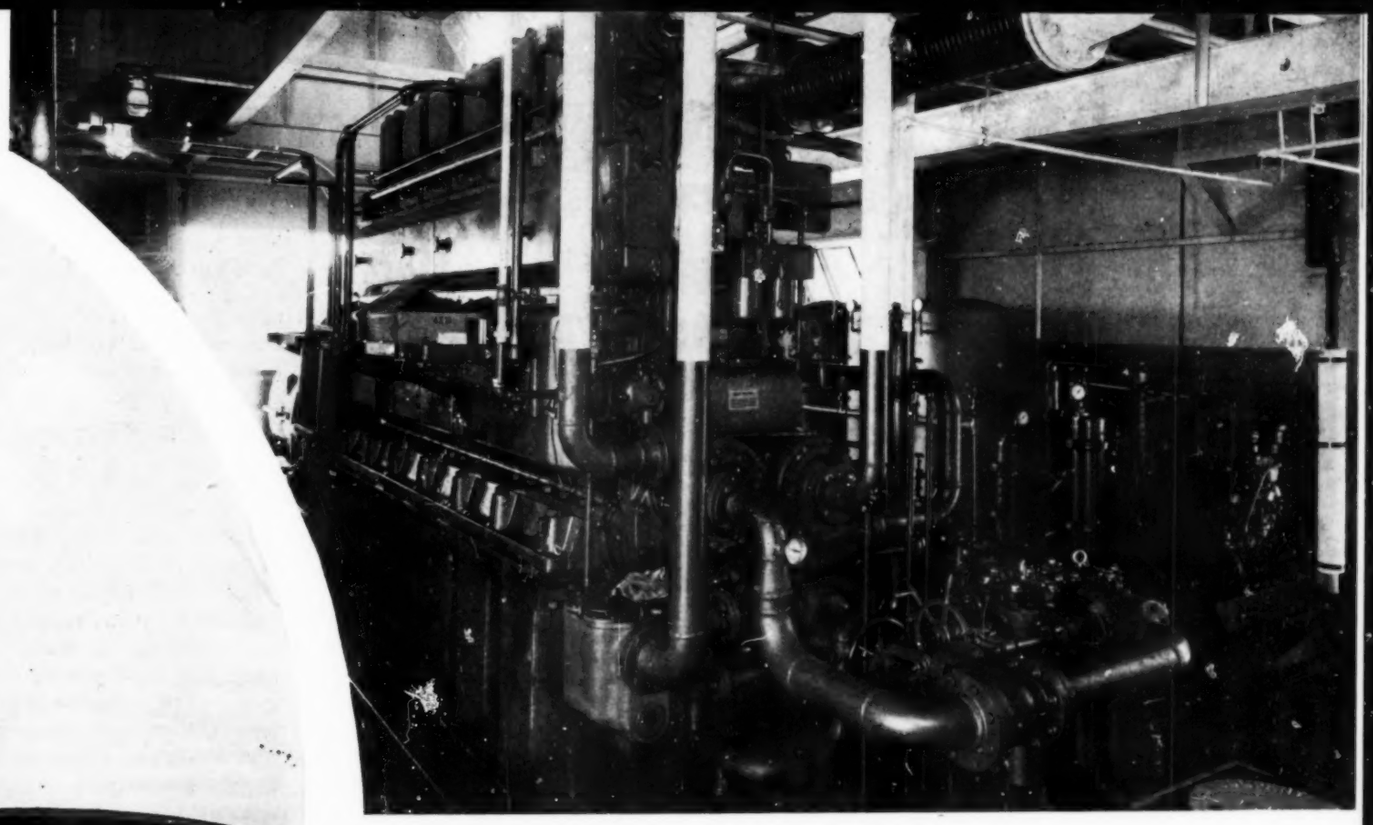
The hull is of all welded steel construction 115 ft. x 32 ft. x 6 ft. The main deck house is divided into three sections: the stern section or pump room contains all pumps, spud hoist and anchor hoist; the center section contains the galley and crew quarters; the bow section houses the main engine, generator, compressors, switchgear and central heating plant. The control house, shaker screens and all chutes comprise the super structure above the deck house. The control house is unique in the fact that it is divided into two floor levels, the lower level housing the shaker screen motors, suction hoist and motor; the upper level containing the controllers for the motors, both levels are accessible by an inside stairway.

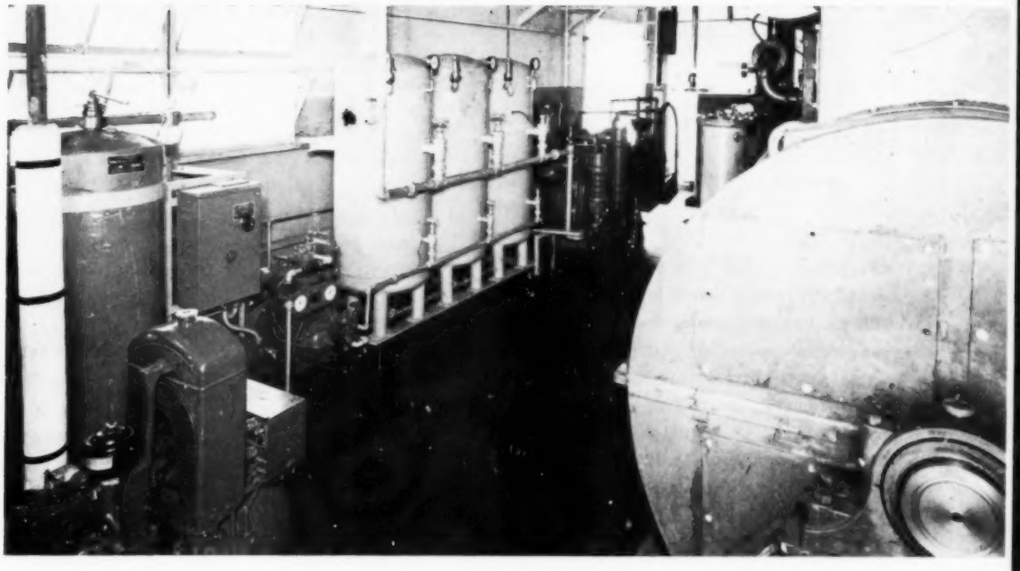
The dredge is electrically powered by a 6 cylinder 12 in. bore x 14 in. stroke four cycle type HD-6 370 bhp. @ 436 rpm. Diesel engine as manufactured by Worthington Pump and Machinery Corporation which drives a 250 kw. 240/120 volt generator by Crocker Wheeler Mfg. Co. of Ampere, New Jersey. The auxiliary generator is a 10 kw.—120 volt type A510 driven by a Hill-Diesel engine. The Diesel fuel is stored in two 10,000 gallon compartments formed by oil tight bulkheads in the dredge hull. Two air compressors are provided, one electric motor driven and the other gasoline powered. The electric motor driven compressor is an Ingersoll-Rand Model 41W used for maintaining air for starting the main Diesel engine. The gasoline driven compressor, an Ingersoll-Rand Model S25BW, is used for operating the air hoist and auxiliary equipment. The main suction pump, a Hydro Seal pump size 14/16 is as manufactured by the Allen Sherman-Hoff Co., Philadelphia, Pa. A Nash vacuum pump Size L is used as a priming pump. The main washing water is provided by three Dayton-Dowd vertical pumps size 4AV 10½ and one Chicago vertical pump size 6 x 8.

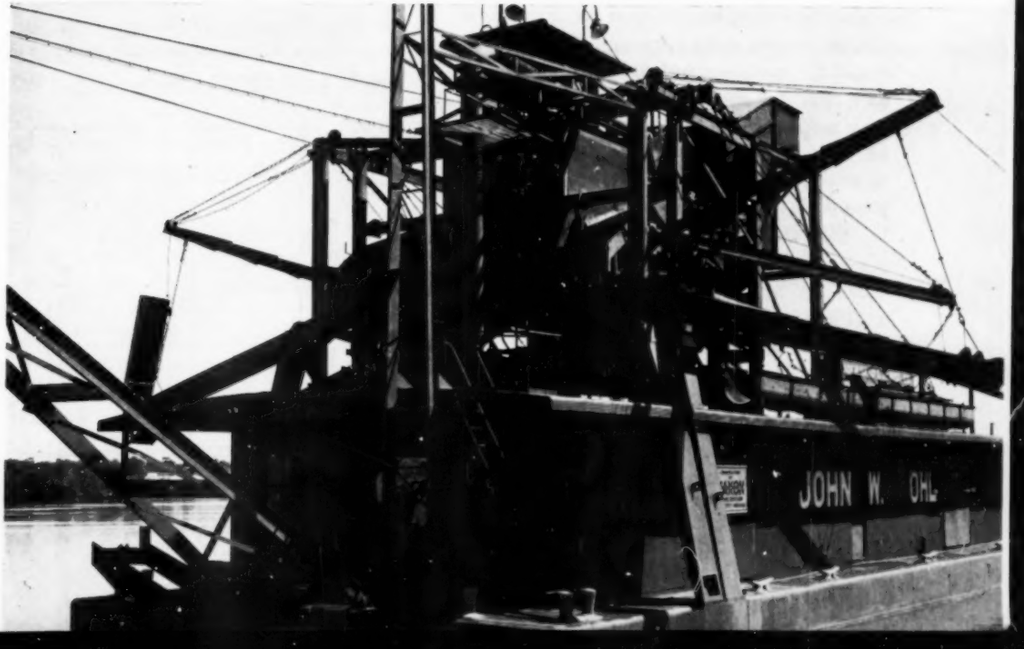
John W. Ohl, 115 x 32 x 6 foot Diesel dredge built by Maxon Construction Company.

All sand and gravel is obtained by pumping and is processed through either of two sets of shaker screens manufactured by W. S. Tyler Company, Cleveland, Ohio. Both sand and gravel are loaded into barges by chutes which are hinged and operated by winches. Ingersoll-Rand Type 9 HR air hoists are provided for handling the gravel chutes. The main suction pipe is raised and lowered by an electrically driven one drum hoist size 12 in. x 6 in. Water for other uses on the dredge is supplied by an A. Y. McDonald pressure pumping system Fig. 420-4, and this water is filtered through a No. 4 Bowden single valve quartz filter.

The crew quarters are complete with sleeping capacity for six men, inlaid linoleum floors, showers and lavatories. The galley is very modern with complete refrigeration, wall cabinets, range, sink and large dining table. Both crews quarters and galley are insulated with Fiberglas insulation.







(Top View) Worthington 6-cylinder, 4-cycle, 370 bhp, 436 rpm Diesel installed on dredge.

Hill Diesel, left foreground, supplies auxiliary power for dredge. 10 kw. 120 volt.

Bow view of *John W. Ohl* showing control house shaker screens and chutes used in dredging operations.

All compartments of the deck house are heated by a forced warm air heating system, oil fired type manufactured by the Rudy Furnace Co. A Rudd hot water heater, Series 600 is provided for hot water.

The *John W. Ohl* was completed and inspected on September 19 by Mr. Koch, Mr. Koenig and John W. Ohl and is now operating on the Ohio River in the Evansville district.

DIESEL ENGINE SMOKE SYMPOSIUM

Rating Diesel Engines on Smoke Curve Basis

By KENNETH J. FLECK*

FIGURE I shows our usual laboratory method of plotting readings taken with the "Caterpillar" smoke meter. (Upper group of curves). The same data is re-plotted to a more exact density scale in the lower group of curves. We prefer to use the first scheme because it can be plotted directly from data taken, and also because it exaggerates the lighter range of smoke. The log-density curves may sometimes be preferred because clear exhaust is "0" and the scale is directly proportional to density. The slope of these curves indicates the actual visual change in smoke. Con-

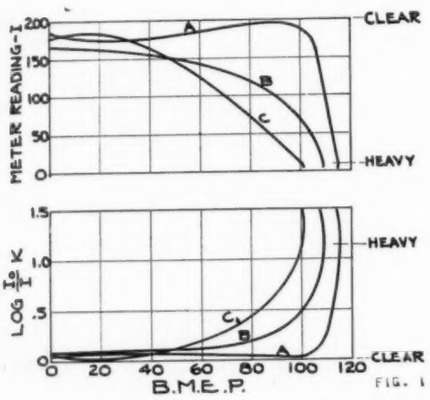


FIG. 1

sider curve A taken from a test run on an engine completely equipped with air cleaner, cooling fan, and all necessary accessories. This engine shows clear exhaust extending close to its maximum power. A sharp break in the smoke curve indicates that the engine limit is only its supply of air. Replotting curve A below sharpens the breaking point, but is essentially the same. Curve B is switched in to represent an engine operating in a light smoke range, either due to poor condition or to a compromise design or application. It can be observed that there is room to improve this combustion system, but the lower "B" curve shows that the exhaust smoke is probably not objectionable if the maximum fuel pump setting is made for a limit of .3 smoke density. Curve C is plotted from actual performance data from an engine a bit on the dark side. It is not too black up to 70 bmep., but should not be rated near its maximum if heavy smoke is to be avoided. When testing high speed, or highly supercharged Diesels, flame is often present in the exhaust, near maximum, and the photocell will not record the smoke as it may come out the exhaust stack. It is necessary to supplement the meter readings with a visual check-up or re-locate the smoke meter pipe. Figure 2 shows a 1000 rpm. performance curve taken from the same data as the previously shown curve A. The absolute maximum output should always be known on development tests. It is usually possible to increase the fuel quantity until a power loss is shown on the dynamometer beam, giving a "fish hook" type of curve. From this maximum point (1), if we reduce the load about 5% to .3 density on the smoke curve (point 2), we can then establish a base line with some degree of accuracy from which engine ratings can be made.

Editor's Note: Continuing with the second part of the "Diesel Engine Smoke Symposium," we present here the last two papers presented at the Annual S.A.E. Meeting held in Detroit. The special Smoke Symposium was held under the Chairmanship of Dr. P. H. Schweitzer of Penn State College. The two papers abstracted here are "Rating Disel Engines on Smoke Curve Basis" by Kenneth J. Fleck, Stuff Engineer, Caterpillar Tractor Company and "Technique of Exhaust Smoke Measurement" by Jordan P. Jung and Frank L. Coers of the Cummins Engine Company.

With the "Caterpillar" smoke meter, this would read 100 Mu amperes and visually would be a light to moderate smoke. This point (2) is considered a practical maximum or danger point, which should not be exceeded for any application and preferably should not be approached too closely. Next should be established a safe load rating point. This safe limit (point 3) will obviously vary for different types of engine applications. However, a production tolerance between individual cylinders of each engine must first be considered. A margin of safety must also be allowed for such items as reasonable "loading up" of air cleaners, normal air density changes, and deterioration due to wear. A 10% cut-back in power will therefore be selected for an example as the safe rating at this speed. Observing the smoke curve again, notice that the smoke curve breaks at this point (3) of approximately 100 bmep. One advantage of normally having a clear exhaust is the danger "smoke signal" effect as things go wrong. A definite safety margin can considered as a "time-factor" extension be nozzles and pistons need attention. In this resp the returns are great, because the real source the trouble has been reduced or eliminated.

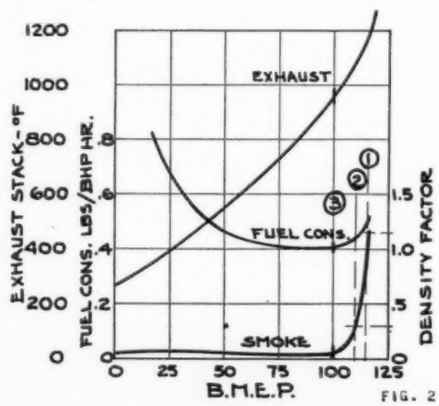
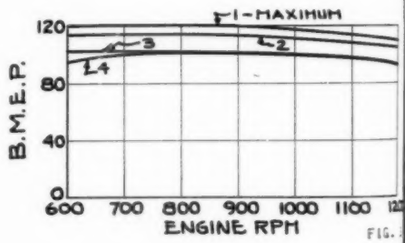


FIG. 2

Results from selection of these three points, m mum (1), operating maximum (2), and safe li (3), are shown on Fig. III. When rating an eng to operate at full torque throughout its sp range, it is necessary to match the governor a fuel injection system to do the job, or set smoke limit stop to avoid smoke at all speeds, a accept some slight reduction in torque at o speeds. Curve 4 show the overall engine load speed with the load stop set at the top spe This natural lug curve, as we call it, closely pa lels the limiting curves 1, 2, and 3 sincerely accident. Engines such as those powering g erator sets and propeller loaded marine engi normally do not approach the safe limit at m than one speed, and are sometimes rated e lower than the break in the smoke curve in interests of extending their service life or depe ability. Again, we should consider the probl



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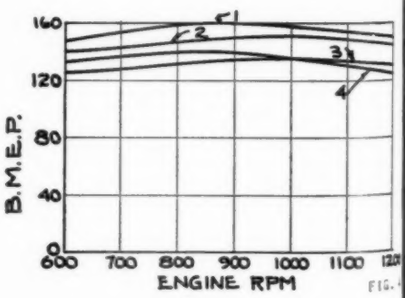


FIG.

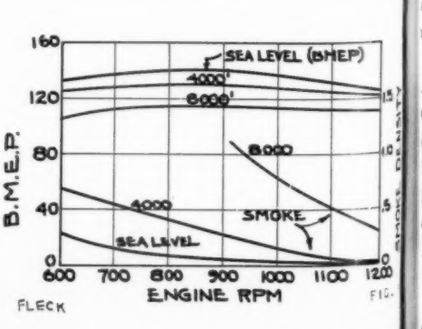


FIG.

FLECK

* *Staff Engineer, Research Department, Caterpillar Tractor Co.*

from the customers point of view, and include all accessories necessary to do his job, since that is the only way he can use the engine. Glancing at the supercharged data, Fig. 4, the rated curve 4 is fixed below the safe limit curve 3 in its normal operating range, and allowed to approach the danger zone 2, on occasional overload. In this case, the natural lug curve does not parallel the engine possibilities and further compromise and judgment must be used.

The final rating curve shown in Fig. 4, Curve 4, for the supercharged engine is re-plotted on Figure 5. The effect of 4000 and 8000 ft. elevations on load and smoke is indicated. The 4000 ft. smoke

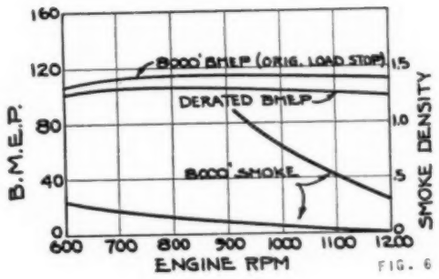


FIG. 6

curve might also be considered as typical of the results obtained when the air cleaner has 4 inches of mercury restriction at sea level. The de-rated altitude curve, Fig. 6 shows only 5%-10% cut in power to have sea level smoke. This supercharged engine derated for clean exhaust at 8000 ft. altitude still has approximately 5% more bmep. than the same engine without the blower at sea level, as shown on Curve 4, Figure 3.

The smoke curve is, therefore, one of the measures of engine performance, and tells a more profound story than exhaust stack temperatures. It would be quite gratifying if some measure of smoke was always shown whenever engine performance data is printed, regardless of whether the data was obtained visually or with some form of instrumentation.

Technique of Exhaust Smoke Measurement

By JORDAN D. JUNG *and* FRANK L. GOERS*

THE goal of the investigation was the establishment of a method of taking a smoke sample which, when measured by a C.R.C. Smokemeter, would give consistently a comparative indication of the density of the main stream of exhaust smoke.

Previous experience with the Smokemeter indicated that a sample obtained with a slotted sampling valve placed across the flow of exhaust gas would be a more representative sample than that obtained from a hole in the side of the exhaust pipe or from a tube with a single small opening placed anywhere in the stream. Such a slotted valve is shown in Figure 1. Two variations of the valve were used in order to study the effect of the slot width upon sampling. The design of the valve permitted it to be rotated so that the relative angle between the smoke stream and the slot could be varied.

With the sampling valve as a starting point, the plan of investigation called for study of the effects on the Smokemeter readings of:

1. Sampling valve slot width,
2. Angle of sampling valve slot in relation to the exhaust stream,
3. Location of sampling valve in exhaust pipe,
4. Diameter of tubing connecting sampling valve to Smokemeter, and
5. Length of tubing.

Variations of points 1, 2, 4, and 5, had been tested for one location of the sampling valve when testing was suspended because of failure of the Smokemeter control box.

All samples were taken from the exhaust of a Cummins Supercharged 743 cu. in., 6 cylinder engine delivering 200 bhp. at 1800 rpm. The full load rating of the engine is 275 bhp. at 2100 rpm. It was decided to use partial loads and speeds in order to obtain moderate yet measurable exhaust smoke. Since, for these tests, the engine was to be used as a smoke generator, load, speed, and specific fuel consumption were held as nearly constant as possible for each Smokemeter sample.

The Smokemeter and other test instrumentation were installed as shown in Figure 2.

At least three smoke density versus charging pressure curves were made for each different set up, one each with .3, .4, and .5 minutes charging time.

The entire Smokemeter system was scavenged with compressed air whenever the engine was down overnight or while changes were being made in the sampling system. This procedure was necessary to clear the system of condensation and was performed just before taking a series of smoke density readings. Once a series of readings was started the steps taken to obtain each reading in the series were as follows:

1. Close Smokemeter inlet valve,
2. Scavenge smoke chamber with compressed air,
3. Set smoke density indicator needle to zero. If adjustment is not sufficient to set zero, clean photo cell lenses,
4. Open Smokemeter inlet valve the necessary amount to give desired charging pressure,
5. Close valve after the chosen charging time has elapsed and read smoke density immediately.

The best angular position of the sampling valve slot in relation to the flow of the exhaust gas was found to be 0° or that position which offered the full width of the slot to the direct flow of the exhaust stream. Figure 3 is a typical curve showing smoke density and charging pressure versus sampling valve slot position.

The merit of the sampling system was judged from the smoke density versus charging pressure curves: the smaller the smoke density variation over a wide range of charging pressure (2 to 18 inches of water), the better the system. In support of this statement, paragraph 4 of Conclusions of the report, "Investigation of Smokemeter Sampling," by Julius J. De Carolis published March, 1947 by the Engineering Experiment Station, The Pennsylvania State College, states, "A simple test for determining good sampling is to gradually throttle the exhaust gases within reasonable limits and observe its effect on Smokemeter readings. If an increase in pressure does not change the smoke density reading, you can assume that the sampling is satisfactory."

Twelve combinations of the sampling system variables were tested. Figure 4 is a chart showing the make-up of these combinations.

Three of the twelve combinations gave good results. These were (1) ¼ in. wide sampling valve slot, ⅜ in. O.D. tubing 24 in. long, (2) ⅛ in. wide sampling valve slot, ⅝ in. O.D. tubing 24 in. long and (3) ⅛ in. wide sampling valve slot, ¾ in. O.D. tubing, 72 inches long. The smoke density versus charging pressure curves for all three are plotted in Figure 5. These curves show that combination #3 gives the highest smoke density reading and one which levels off at a charging pressure which is much lower than for the other two. A further advantage of combination #3 is its longer tubing which permits the system to be adapted to various engine installations much more readily than the short tube connecting the sampling valve to the Smokemeter.

During the latter phases of the investigation, the "dead" sample method of checking smoke density was questioned. Why not throttle the gas passing into the smoke chamber to a charging pressure which falls within the flat portion of the charging pressure smoke density curve and then read the smoke density while the gas is passing through the meter? Some checks were made which proved the feasibility of the system. It was found that the density indicator needle would swing to

* *Cummins Engine Company.*

a maximum reading and remain there within .2 minutes after introduction of the "live" sample at approximately 12 inches of water charging pressure. With lower charging pressures, correspondingly more time elapsed before the needle would stop climbing. Smoke density indications of the "live" samples ran 1 to 2% smoke density higher than the indications of the "dead" samples with all other conditions of test equal.

Use of the "live" sample system would eliminate the necessity for measuring the charging time and would allow the operator to read the smoke density meter more at his leisure rather than make a "snap" reading at a predetermined instant.

It was decided that the "live" sample system would be investigated more thoroughly after a combination of sampling valve slot width and sampling tubing length and diameter had been established which would give a flat density versus charging pressure curve. Just after this combination was found, it was necessary to send the Smokemeter and control box back to the manufacturer for repair. Its return is not expected until sometime after this paper has been published.

Conclusions

A flat smoke density–charging pressure curve can be obtained with a sampling valve having a 1/8 in. wide slot located in the exhaust pipe 43 inches from the exhaust manifold flange and connected to a C.R.C. smokemeter with 72 inches of 3/4 in. O.D. x 1/16 wall copper tubing.

A good procedure for obtaining and measuring a smoke sample is as follows:

1. Scavenge entire sampling system with compressed air to remove condensation after warming up the engine.
2. Set smoke density meter needle to zero. If adjustment is not sufficient to set zero, clean photo-cell lenses.
3. Open smokemeter throttling valve to give at least eight inches of water charging pressure and leave valve open for .4 minutes.
4. Close throttling valve.
5. Read smoke density immediately.
6. Scavenge smoke chamber before taking next smoke sample.

It is believed that the following simpler procedure will give results equally as good as the above. However, further testing of it is recommended.

Live Sample Method

Steps 1 and 2 same as in above procedure.

3. Open Smokemeter throttling valve to give at least eight inches of water charging pressure.
4. Read smoke density when meter needle stops climbing.
5. Scavenge smoke chamber before taking next smoke sample.

Further laboratory work for the refinement of the smoke sampling setup and smoke measurement technique is scheduled in order that Smokemeter determinations may become dependable enough to be considered in our engine development program.

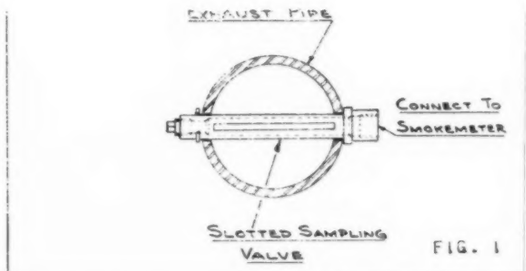


FIG. 1

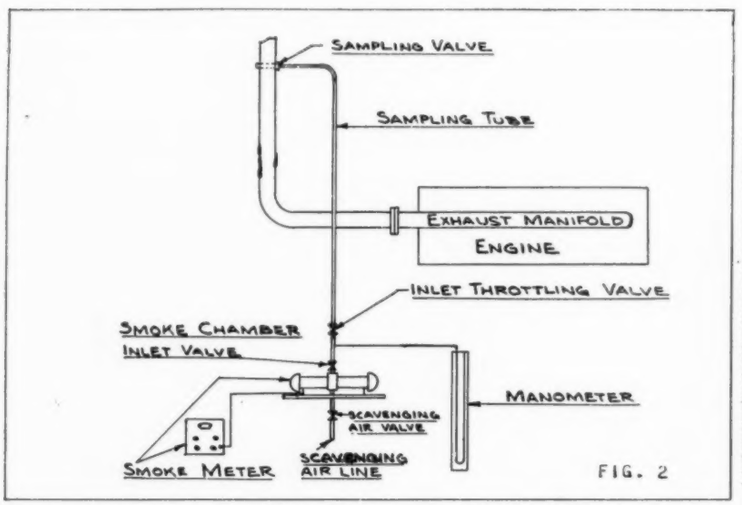
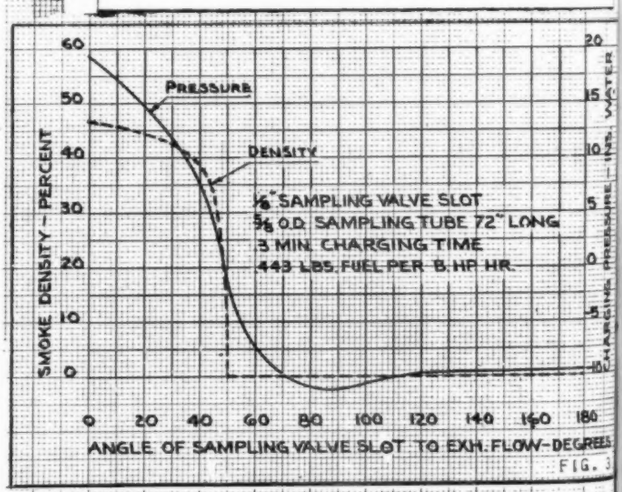


FIG. 2


SMOKE DENSITY - PERCENT
CHARGING PRESSURE - INCHES WATER
PRESSURE
DENSITY
1/8" SAMPLING VALVE SLOT
5/8 O.D. SAMPLING TUBE 72" LONG
3 MIN. CHARGING TIME
.443 LBS. FUEL PER B.HP. HR.
ANGLE OF SAMPLING VALVE SLOT TO EXH. FLOW - DEGREES
FIG. 3

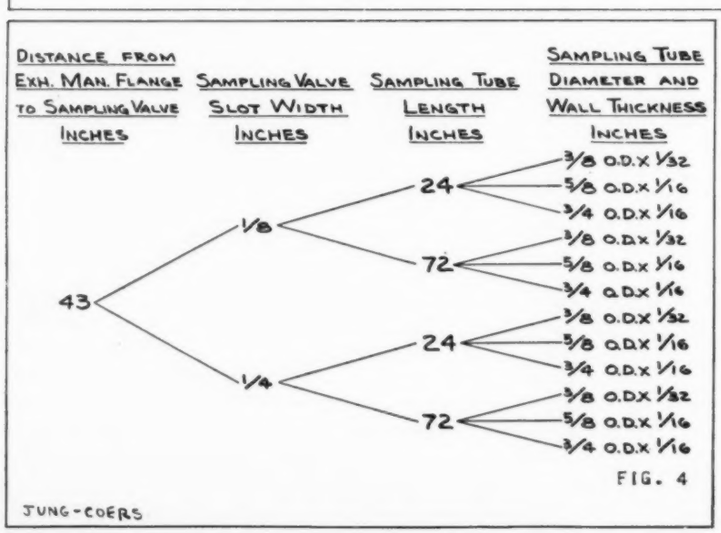


FIG. 4

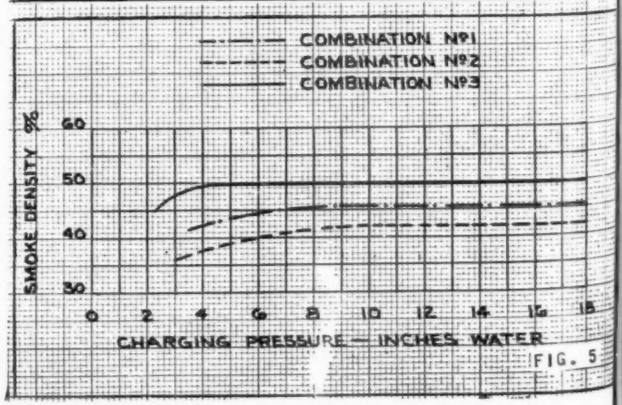


FIG. 5

20th ANNUAL OIL AND GAS POWER CONFERENCE

will Feature Fiftieth Anniversary of the Diesel Engine in America and Special Pre-Conference Lubrication Lectures

A dynamic, comprehensive program marks the 20th Annual Conference of Oil and Gas Power Division of A.S.M.E., scheduled to be held on May 20, 21 and 22 at New Hotel Jefferson in St. Louis, Missouri. The Year 1948 is the 50th anniversary of the Diesel engine in America, a fitting theme around which is centered the entire Conference program.

Prominent American and Foreign Diesel engineers and power experts are scheduled to review outstanding features of Diesel engineering and application. In addition, there are planned inspection trips of prominent manufacturing establishments in and around St. Louis, as well as a Ladies' Program for those of the distaff side who may be present.

Registration planned for 9:30 A.M. on Thursday, May 20.

Social

On the social side, a Luncheon on opening day will feature Mayor A. P. Kaufmann of St. Louis. The Annual Banquet, informal as usual and open to the Ladies also, will be held on Friday evening, preceded by an Exhibitor's social hour. Glenn C. Boyer, O&GP Chairman, will preside; toastmaster will be Gordon Le Febvre, president of Cooper-Bessemer Corp. and president of Diesel Engine Manufacturer's Association; Joseph Holland, prominent St. Louis banker, will deliver the main address of the evening.

Exhibits

As in the past, there is to be an exhibit of the products manufactured by leading builders of the Diesel and related industries. The numerous advance reservations for booth space indicate that this feature of the Annual Conference will be more imposing and informative than ever before.

Pre-Conference Lecture

Continuing an engineering service feature first instituted at the 19th Conference, where the subject of "Diesel Fuel Oils" was presented, the Division is arranging a special series of features dealing with the ever important subject, "Lubrication." This series, to be held at New Hotel Jefferson on May 19, will be presented in three 2-hour lectures by two recognized experts of national repute. Mayo D. Hersey, Research Associate, Massachusetts Institute of Technology, will discuss "Basic Principles of Lubrication" and "Engineering Applications of Lubrication;" and Dr. James B. Rather, Jr., Technical Service Department, Socony-Vacuum Laboratories, "Manufacture, Classification and Test Significance of Lubricating Oils."

Registration, which will be restricted to approximately 100 engineers, should be made by mail to the Special Lectures Chairman, John C. Gibb, Room 1348, 26 Broadway, New York 4, New York. Fee for the complete series, payable in advance on application, is $12 to A.S.M.E. members and $15 to non-members (checks should be payable to American Society of Mechanical Engineers, O&GP Custodian Fund). Those interested are advised to make application without delay.

As a convenience to those attending the Lectures, a special luncheon is planned for 12:15 P.M., between the morning and afternoon lectures.

Tentative Program of Technical Sessions

Thursday, May 20

10:30 A.M. "Improved Techniques in Firing Order Studies with the Vectorscope," by George Dashefsky, Brooklyn Navy Yard.
"An Improved Method for Computing Torsional Vibration Systems," by Dr. A. W. Hussman.

2:00 P.M. "Early Developments of the Diesel Engine,"
by C. E. Beck, Nordberg Manufacturing Company.
"Present Day Diesel Engines,"
by Ralph L. Boyer, Cooper-Bessemer Corp. (for large engines).
"Present Day Diesel Engines,"
by Mr. Bennett, International Harvester Co. (for small engines).

8:00 P.M. "Diesel Engineering Developments During the Last Half Century" and "Future Diesel Developments," by C. G. A. Rosen.

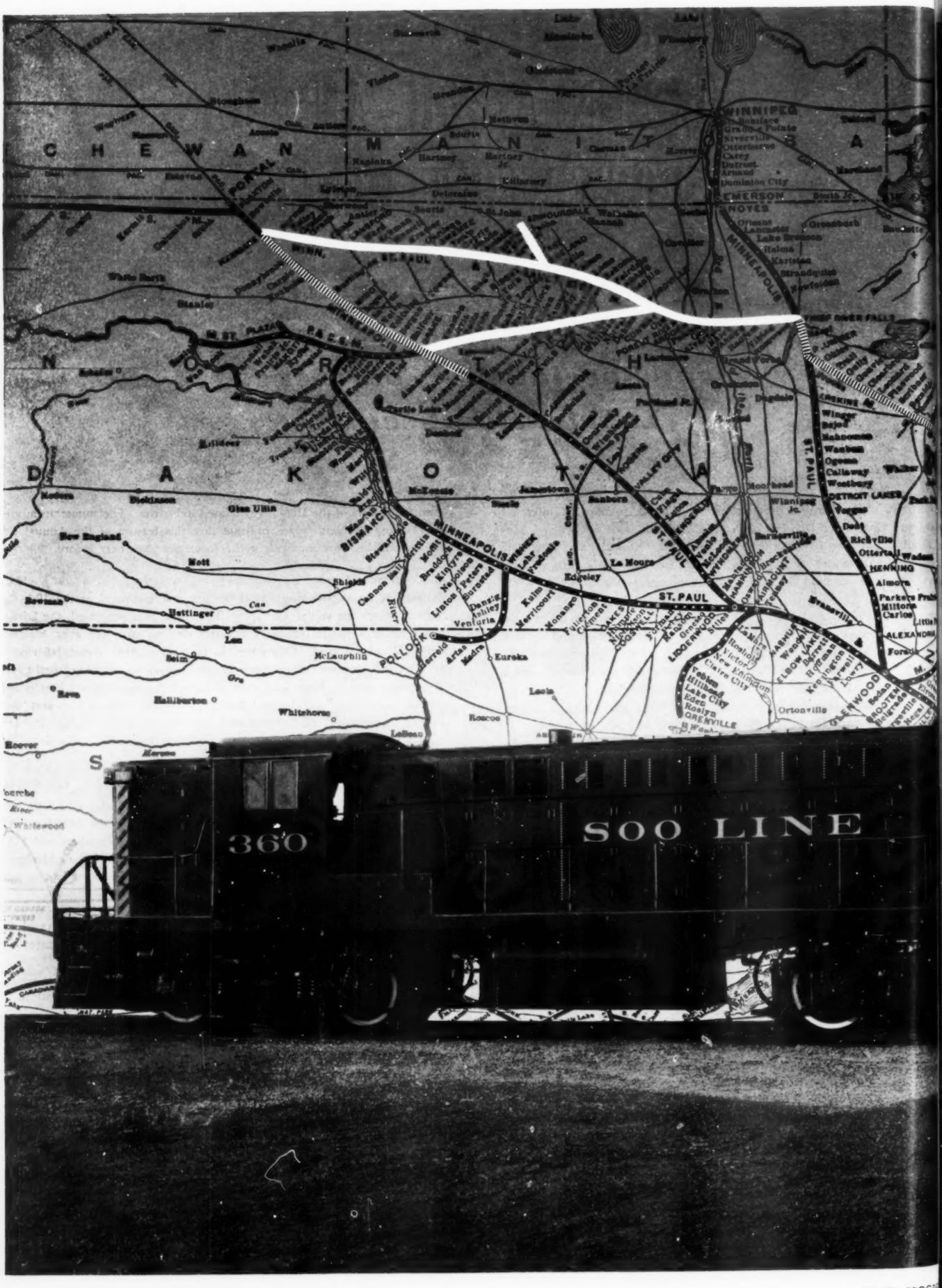
Friday, May 21

9:00 A.M. "Diesels in Industry,"
by W. T. Watt, Vice-President, "Industry and Power."
"Diesels in Inland Waterways Operations,"
by A. R. Parsons, St. Louis Shipbuilding and Steel Co., and Donald T. Wright, Editor, "Waterways Journal."
"Diesels on Salt Water,"
by Walter L. Green, American Bureau of Shipping.

1:30 P.M. "Inspection Trips"

Saturday, May 22

9:30 A.M. "Centrifugal Blowers for Diesel Engines,"
by Robert Cramer, Jr., Nordberg Mfg. Co.
"Diesels on the Rails," by John Morris, Santa Fe Railroad.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MINOT
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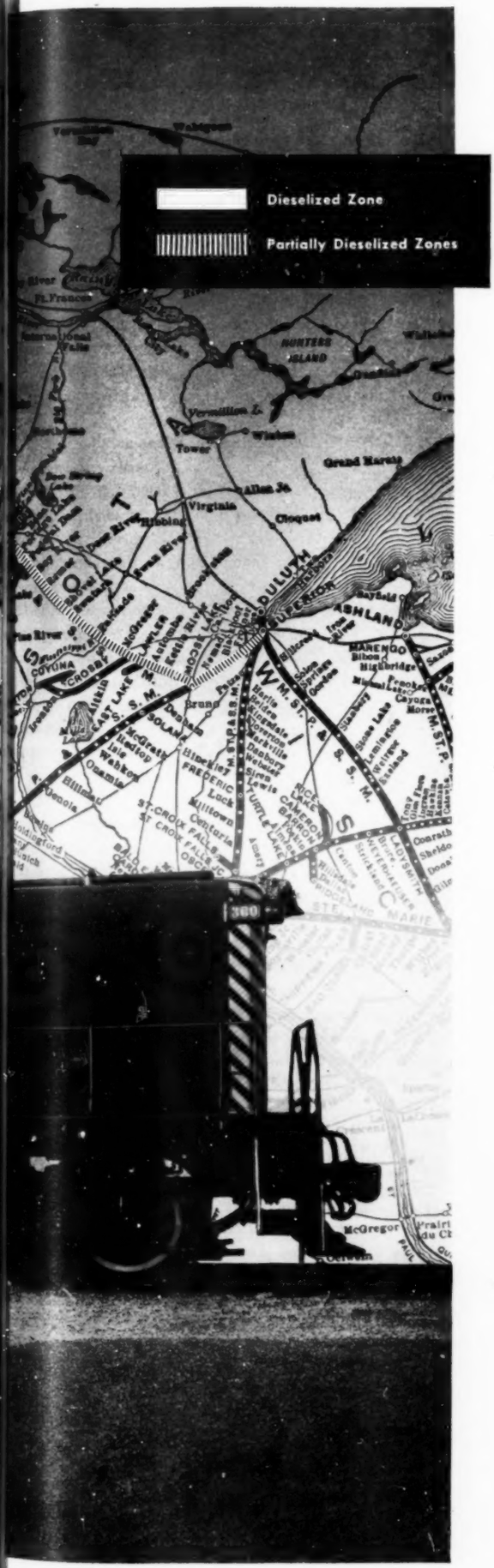
SOUTH DAKOTA



portion of Soo Line completely Dieselized

The Soo Line is now taking delivery of eight Baldwin 1500-hp. diesel-electric locomotives which will be used to completely dieselize the lines from Thief River Falls to Kenmare and from Fordville to Drake.

During the heavy grain movement season all eight diesels will operate in this district. During periods of other than peak traffic some of the diesels will be operated, along with steam power, from Thief River Falls to Superior and from Harvey to Kenmare. They will also be used for switching service at Thief River Falls. Steam locomotive servicing facilities will be maintained at Kenmare, Drake and Thief River Falls, but at all intermediate points the steam facilities will be eliminated.

This plan of operation places the Soo Line in position to proceed with progressive dieselization of its lines as occasion demands.

BALDWIN BLW THE BALDWIN GROUP

The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Boston, Cleveland, St. Louis, Chicago, Birmingham, Houston, San Francisco, Washington, Pittsburgh, Seattle.

SUPERVISING & OPERATING ENGINEERS' SECTION

Conducted by R. L. GREGORY*

UNIT INSTALLATION AND ITS EFFECT ON DAILY OPERATING PROBLEMS

Part 9.

THE last discussion on the above subject appeared in the December issue. We will continue the discussion by giving further features connected with the blower and scavenging arrangement. Both the intake piping and discharge piping are equipped with expansion joints. These joints are made of heavy rubber and serve two purposes, first as an expansion joint, and secondly to deaden any vibration or transmission of noise from the blower.

The blower operates at 3600 rpm. and is driven by a 300 hp. synchronous motor, direct connected to it. The inlet is axial, while the discharge is tangential, and the casing is so constructed that it may be assembled with the nozzle pointing in any direction, within the limits of the bolt circle. This feature is most desirable where this type of blower is used in different layouts.

The impeller is of the semi-enclosed type and has radial blades. Both blower and motor are mounted on a one piece bedplate of welded construction. The oiling system of the blower is unique in that it is equipped with both ring oilers and pressure lubrication, the pressure maintained being around four pounds. The oil rings assure lubrication when starting and stopping, before the pressure is fully built up. In the pressure system the oil is supplied by an oil pump from a sump. This pump is of the gear type, driven from the blower shaft by a spiral gear. The system is so arranged that the oil is continually filtered and cooled by means of a water cooler.

The filter and air intake rooms are built directly above the blower room. The air is taken in through a 30 inch intake pipe which extends above the roof of the main Diesel building, and which is protected at the top by a weatherhead fitting. The air is drawn into the first air chamber and thence through two revolving, self cleaning screens with an oil bath. These screens are periodically cleaned by an air blast supplied from the starting air bottles and controlled by a time clock which operates a solenoid air blast valve.

As the air passes through these screens into the second air chamber it is picked up by the blower through the inlet pipe. This inlet pipe extends about two feet above the floor and is cut off diagonally so that the low edge of the pipe is toward

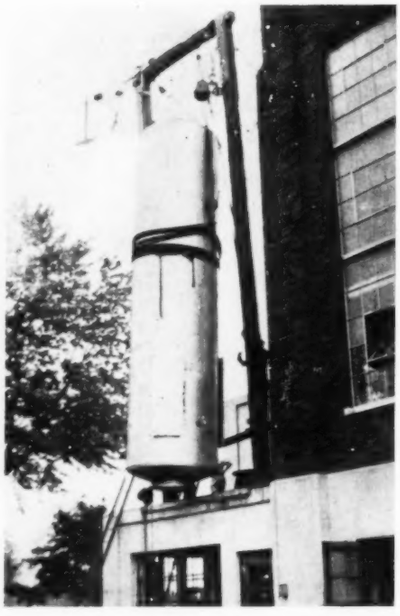


Fig. 1.

the filters. Over this opening a fine heavy screen has been securely fastened, to prevent any foreign material entering this suction pipe, when workmen happen to be working in this room while inspecting or making repairs to equipment.

Another feature worth mentioning is incorporated in this installation. Since the filter room and air intake chambers are built directly above the blower room, a large opening, equipped with louvers has been installed in the floor of the first air intake chamber. These louvers can be opened in cold weather and warm air be taken from the blower room and thence through the rotary filters, which eliminates using the extremely cold air in the scavenging header.

Another feature to be noted on this unit, is that of the 4-inch breather pipe which comes off the number 1 A frame just above the main bearing, runs the full length of the unit and is welded into the suction line of the blower. This maintains a partial vacuum in the crankcase.

The air discharges from the blower into the discharge header and thence to the scavenging header. Here too we find another feature important in operation. In the discharge pipe, above the operating floor and about waist high, there is an externally operated damper which can be ope or closed to regulate the amount of scaveng air, as requirements necessitate. Atmospheric c ditions, load conditions, etc., make it necessary regulate this scavenging air when operating.

This blower arrangement has another unique f ture. The blower being driven by a synchron motor immediately starts operation with the u It derives its excitation from a small pilot exci and the motor is connected directly to the ter nals of the generator. With the pilot exciter the starting air is applied and as soon as the engi starts turning over the blower also begins to fu tion and supply scavenging air to the unit. Wh the Diesel is up to speed, the pilot switch is thro to the second position, cutting in the unit exci tion and disengaging the pilot exciter. The amo of air required for a given load is then establish by manipulating the butterfly valve on the exha blower line, previously mentioned.

The starting air supply arrangement consists eight starting bottles also located in the blow room. These are hooked in multiple, four ta to a bank. The air is supplied to them by me of an air cooled motor-driven compressor, equipp with an unloading valve and automatic shut when the pressure reaches a determined point, this case 250 pounds. In this particular case t compressor is started manually, then forgotten it automatically shuts down when the tanks a filled. However in some cases it is desirable have a low cut-in and high cut-out arrangeme

Since the blower room is adjacent to the ma operating building, it is equipped with a Un heater to heat the building when the unit is dow When the blower is in operation it generat enough heat from operation to keep the buildin warm and comfortable except in the extreme cold weather. Since the heater is thermostatica controlled, the unit heater supplies any additiona heat that may be required.

Figure 1 shows the exhaust muffler just before was placed on its base on the blower room roo It was raised high enough to clear the base, the the "A" frame was straightened into a vertic position, by means of the block and tackle gea which were attached to it in all four direction The gasket was then placed on the base and th muffler lowered into position and bolted dow

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* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*

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Either way, the chances are that the oil or water cooling will be done by a "BCF" unit when your next hydraulic press, plastic injection molding machine, die-casting machine, Diesel or gas engine, compressor, hydraulic coupling, torque converter, reduction gear, thrust bearing or turbine is placed into operation.

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It will be well worth your inquiring about the type oil or water cooler planned for your equipment. If it's not a Ross "BCF", familiarize yourself and then *insist* upon it! *Bulletin 4922, with complete design details, will be furnished gladly upon request.*

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Exchange Your Diesel Maintenance Ideas

Conducted by R. L. GREGORY

Editor's Note: In this department we provide a meeting place where Diesel and Gas engine operators may exchange mutually helpful maintenance experiences to keep our engines in top condition. Mr. Gregory edits your material and adds constructive suggestions from his own wide experience. This is your department—mail your contributions direct to DIESEL PROGRESS.

Another Method for Removing and Cleaning Up the Shoulders on Liners

SEVERAL methods of doing this work have been suggested in the past and the most frequently used possibly has been that of a portable grinder with a flexible shaft and emery stone. However many plants do not possess a portable grinder and use a regular bench grinder or an air driven portable grinder.

Any maintenance man who has done the work with this method, knows that it often becomes quite a chore to hold such a grinder and guide it properly and it soon becomes very tiresome. It is also almost impossible to secure a nice smooth job with this method.

We overcame this difficulty by making a clamp for our grinder, out of two half bands of light band iron, securely bolted together like a clamp around a symmetrical part of the grinder body. To this we fastened a U shaped hanger and by means of a small rope block and tackle hung the grinder on the hook of the traveling crane. By means of this block and tackle we were able to raise or lower the grinder and swing it in almost any desirable position on the surface to be finished.

We furthermore substituted a hard rubber disc for the usual emery wheel. This disc is easily made by securing a sheet of hard rubber, preferably ¼ in. thick and by use of a lathe, turn out a disc of approximately the same diameter as the emery wheel. We secured several endless bands of Mineralite cloth of varying grades of courseness and placed one of these on the outside circumference of this disc, starting with a course grade and graduating down to the finer grades as the work progressed.

When completed we had a nice smooth surface, well polished and all in all it made a finished job. The use of this hard rubber disc with a wide grinding surface, did away with the bobbing and bumping around which we encountered in the use of an emery wheel, and had a tendency to give a smoother finish to the job and a more uniform cleaning job, and while it may take a little longer to remove the shoulder with this arrangement, than with the use of an emery wheel, the results are much more gratifying.

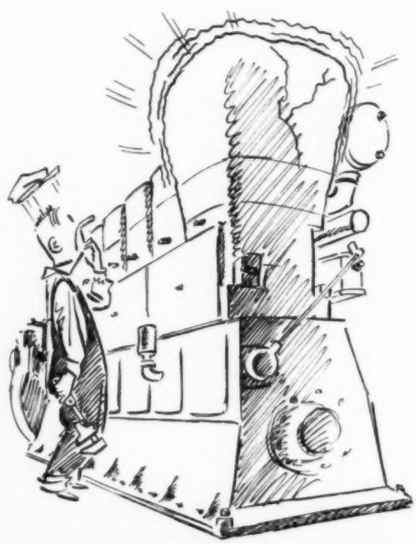
Filtering Lubricants

We are all more or less familiar with the various types of oil purifiers and their operation. Many plants have individual oil and purifiers of varying makes as permanent accessories on their engines.

Recently our plant acquired three large oil purifiers of a standard make, which are just the equipment for purifying oil. Each of these units are mounted on a sheet metal base, which base also has an oil pump connected to the purifier. The whole metal base is mounted on heavy casters and the suction and discharge lines from the pump are equipped with heavy hose.

Two connections are made to our engine crankcase, the discharge connection considerably above the oil level, and the suction line at the bottom of the oil sump. These connections are equipped with good valves for closing. The oiler or operator wheels one of these units up to an engine, attaches the suction hose to the suction line from the sump and the pump suction and likewise the discharge hose to its proper connections.

Then he puts the filter in operation and lets it run, inspecting it as he makes his rounds. The filter can be left on the unit for any required



time and when finished can be moved to another unit and the process repeated on that unit. In this manner the purifier becomes a very flexible accessory to the plant and can take care of several units, thus eliminating the necessity of several individual units.

When the charge of the filter becomes pretty well filled with sludge or refuse from the oil, he simply wheels the unit to some convenient place for cleaning, cleans the filter and puts in a new charge. Then he is again ready for filtering. This portable arrangement does away with a lot of messy and oily accumulation which generally accompanies a stationary job when cleaning and recharging. It likewise cuts on the cost of equipment, since these purifiers are large enough to handle a unit we have.

How To Fasten a Thermometer On a Bearing Cap

We wanted to install a thermometer on the governor end main bearing of our Diesel engine in order to determine how much warmer this bearing was running in comparison to the other main bearings. Since this cap had not been drilled and tapped for a thermometer, we fastened the thermometer to the bearing cap by means of putty. The bulb of the thermometer was fastened so that it made good contact with the metal of the bearing cap. This arrangement has served its purpose for the last four years. We have thermometers on all the main bearings of our Model 32E14 Fairbanks, Morse engines and a check is made of the temperatures regularly.

How To Soften Dried Out Gaskets

Sometimes the paper or composition lid gaskets become dried out when stored for some time. When these gaskets are straightened out, they crack and thus become ruined. We found that the best way to prevent them from cracking is to soak them in water so as to make them soft and pliable before they are used.

More on Pumping Oil Barrels

IN the March issue M. L. Monson described a method of pumping oil from barrels by use of air pressure. A letter recently received from H. J. Clarke of the Chicago Bridge and Iron Company warns that this method can be very dangerous since air pressure can build up rapidly inside the barrel and cause an explosion. His firm has stopped the practice entirely.

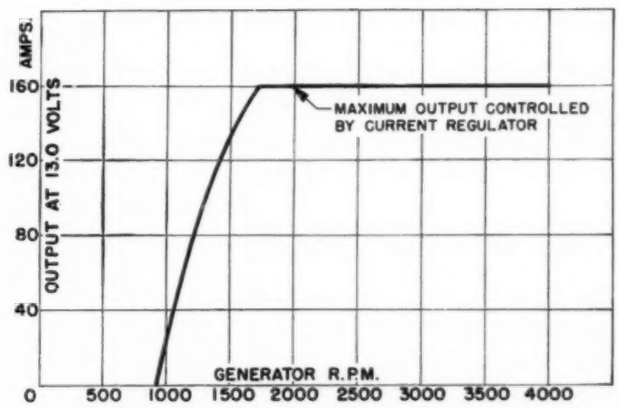
A NEW DELCO-REMY
GENERATOR AND REGULATOR

Combining High Output with Minimum Weight for Cross-Country Diesel Applications

This new Delco-Remy generator and regulator combination has been especially developed for cross-country buses and other high-speed applications.

Weighing only 60⅜ pounds, the generator is a 12-volt model capable of sustained 160 ampere output at cruising speeds. Compact construction permits the use of a short frame, 8½ inches in diameter. The armature shaft is supported by a roller bearing at the drive end and by a ball bearing with a grease seal in the commutator end. Interpole construction improves commutation and output.

The higher field current required by this generator is efficiently controlled by the new carbon pile regulator. Working together, these new units produce a smooth, powerful flow of current, well-controlled and ideally suited to their applications.



Typical hot performance curve for one of the new type generators. Note the high output at moderate armature speeds.

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D.E.M.A. Activities Scheduled

NEXT general meeting—At noon, Tuesday, May 18, 1948, there will be a joint meeting of chief engineers of the companies that build Diesel engines and representatives of the companies that are supporting the DEMA educational program. This meeting will be held at the Statler Hotel, St. Louis.

This session will be an all-afternoon affair. The first part of the program will be devoted to a review and a discussion of the educational program. The last half of the afternoon will be a round-table discussion of the ways and means whereby the builders of Diesel engines can work more efficiently in cooperating with the people who furnish parts and accessories.

Intake and Exhaust—Professor W. P. Green, Director of Engine Noise Research for Illinois Institute of Technology, has been engaged to prepare a pamphlet on Diesel engine Intake and Exhaust Systems. He will cover such subjects as Air Filtration, Intake Silencing, Supercharging and Exhaust Silencing.

Lubrication—Profesosr E. B. Watson, Cornell University, is preparing a similar pamphlet on Diesel Engine Lubrication. These two pamphlets are the first steps taken toward improving Diesel engine undergraduate text material.

School for College Professors—Cornell Univers is going to conduct a week's conference start August 30 for college professors who teach cou in Diesel engineering. In addition to the pro sors attending this conference, provisions h been made to allow 15 engineers from the Di industry to attend. Each of the companies s porting the educational program will be given opportunity to enroll one man from its staff this course.

The week's course will cover, among other thi the following subjects: Intake and Exhaust S tems, Fuels, Fuel Injection, Combustion, Lub cation, Supercharging, Cooling, and various s jects of a practical nature concerning laborat equipment, text material, courses, etc.

Accessory Exhibit—Cornell University is going invite the accessory manufacturers to furnish hibits of their products for display at the Univ sity during the time of the conference next Fa The purpose of these exhibits is to show t school people attending what the different co panies have and how it can be used for educatio purposes. Anyone interested in participating this exhibit should write to Professor Israel Ka Dept. of Mechanical Engineering, Cornell Univ sity, Ithaca, New York. He has charge of th phase of the program. There will be no char for exhibit space.

Dynamometer Survey—D.E.M.A. has a compl record of the Diesel engine equipment in t schools and is now proceeding to get the fa concerning different types of accessory equipme The first survey will cover dynamometers.

Prominent Marine Industry Associations to Participate in Third National Marine Exposition

ROGER E. MONTGOMERY, President an General Manager of National Marine Exposition Inc., announced recently that the following lea ing marine industry associations have accepted i invitation to participate in the forthcoming Thir National Marine Exposition, to be held at Gran Central Palace next May 17-22: American Pilo Association, American Steamship Purchasin Agents Group, Army Transportation Associatio Association of American Shipowners, Robert L Hague-Merchant Marine Post, Mississippi Valle Association, National Federation of Americ Shipping, Port Stewards Association of New Yor Association Water Transportation Accountin Officers, Maritime Association Port of New Yor American Merchant Marine Institute.

A special section of the big show's space has bee set aside by the management, Mr. Montgome stated, for use by the participating groups an their members for displays pertaining to the activities and as a place to meet their many indus try friends.

NO ONE ACCESSORY Does More
• To Improve Engine Performance
• Reduce Wear, Maintenance and Repair
• Lengthen Engine Life
THAN A GOOD OIL FILTER

A *good* oil filter quickly pays for itself many times over. Besides increasing engine life and reducing wear, thoroughly filtered, cleaned oil provides the kind of lubrication that insures full-power engine performance. Furthermore, oil costs are cut and repairs or replacements reduced.

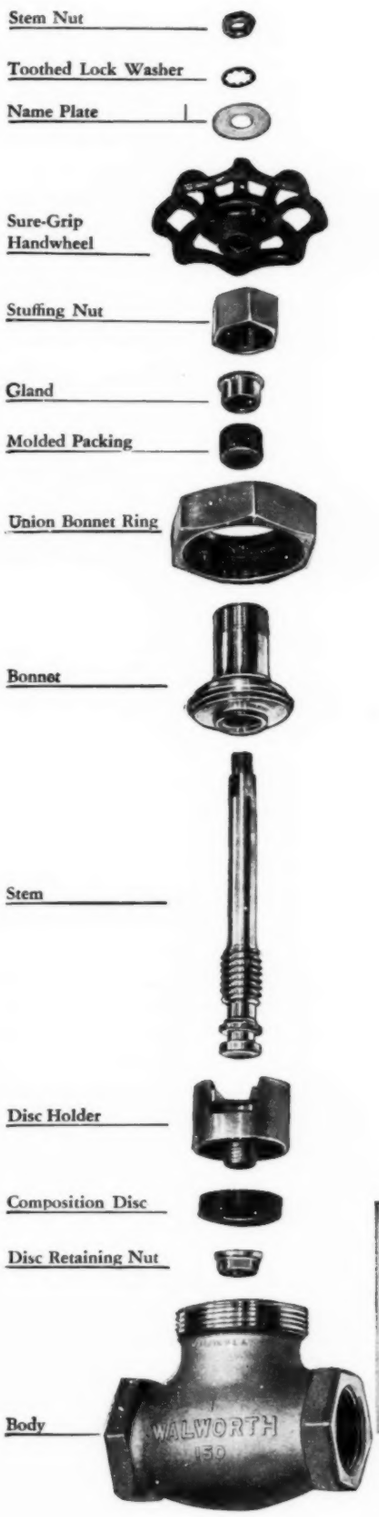
From actual comparisons of tests and long range performance records — fleet operators, engine builders and users select and use MICHIANA Filters.

MICHIANA Filters are economical too — they are efficient for long mileage and are easily made good as new by replacing the element or filter material.

You make money regularly on the MICHIANA Filters you install. Write for Bulletin 839 to MICHIANA PRODUCTS CORPORATION, Michigan City, Indiana.

MICHIANA OIL FILTERS

Request your copy of latest illustrated Bulletin 839 today.



TO MAKE A GOOD VALVE BETTER

Walworth has redesigned and improved its No. 95 Quality Bronze Globe Valve.

150 pounds working steam pressure at 500F

300 pounds cold water, oil, or gas.

Can be repacked under pressure when fully opened.

The Walworth No. 95 Bronze Globe Valve has always been tops with piping men because they liked these features: Renewable composition disc; lock-on, slip-off disc holder; union bonnet construction; deep stuffing box; tough bronze body made of Composition M (ASTM B61).

Now Walworth has added these improvements: (1) New cylindrical disc holder that accurately guides the disc to the seat, regardless of the position in which you install the valve. (2) Newly designed, air-cooled, sure-grip handwheel that you can grab and turn, even when wearing greasy work gloves. It has a tapered square hole sized to gage to fit snugly on the finished square of the stem. (3) Toothed lock-washer to prevent the stem nut from becoming loose. (4) All parts have been redesigned to give maximum service and strength.

Walworth Quality Bronze Valves are available in Globe (No. 95), Angle (No. 96), or Check (No. 97) types and in sizes from ¼ to 3 inches (check valves ¼ to 2 inches). Ask your Walworth distributor to show you the improved Walworth No. 95 Bronze Valve, or write for further details.

WALWORTH

valves and fittings

60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Diesel for Chile

. . . . *Continued from page 24* . . . . .

The bearing lubrication system which is of the pressure-feed type, circulates oil under pressure to all working parts of the engine and also cools the main piston heads. The hot oil coming from the bearings and the piston heads runs down through the crankcase back to the engine luboil sump located in the basement. Alongside the sump tank, which has a capacity of 2,000 gallons, there are three 30 hp. motor driven, Quimby, helical gear pumps of 500 gpm. delivery each. Two of these units are required to pump the necessary amount of luboil through the Elliott twin strainer and the Ross coolers back to the pressure oil header inside the engine, where, at present, a pressure of 32 psi. is maintained. The third pump, which acts as a standby, cuts in automatically should the oil pressure drop below a predetermined amount for any reason.

A relief valve set for 60 psi. maximum pressure was installed ahead of the Elliott strainer which discharges into the sump tank, and thereby limits the delivery pressure of the positive displacement pumps.

On account of the elevated temperature of the cooling water, two Ross coolers type CP-3111 were necessary. These coolers, as shown in the photograph No. 1, are set up vertically. A hatch opening was provided in the engine room floor immediately above the coolers in order to facilitate their handling, especially when they have to be removed for cleaning. The coolers have a shell diameter of 31⅝ inches and they are 13 ft. 5 in. long. Both circuits, oil and water, are connected in series and the full flow of cooling water for the whole of the engine passes first through these coolers.

The total amount of luboil in circulation within this system is about 2,900 gallons, and the type of oil being used at present closely approximates the specification recommended by the factory. The average temperature difference between the oil inlet and outlet of the Ross coolers is about 15° F. with the hot oil reaching an upper limit of 135° F.

In order to keep the circulating lubricating oil in good condition, two Honan Crane purifiers, type 3036 M 20 also were installed next to the luboil sump tank in the basement (see photo 1). A small Viking pump takes the oil from the sump and circulates it under pressure through the two purifiers, connected in parallel, and back to the tank. These purifiers are of the dry cartridge type. They are equipped with thermostatically controlled electric heaters and each one has a capacity of 80 gallons per hour. With both of them in operation they will filter the entire luboil batch within approximately 18 hours. A small amount of the circulating oil is contaminated on the cylinder walls and pushed through the lantern gland by the wiper rings. This loss amounts to about a barrel and a half per month, which is the only make up which has been required up to now.

Fuel Oil System

Pedro de Valdivia is at present using two types of fuel. A Bunker C type is burnt in the boilers and furnaces, while the fuel used for the power house is a refined high grade crude oil of around 28-30 Beaume A.P.I. This fuel has an average calorific value of 19260 Btu. It has an excellent ignition quality with a flash point of 180° F., a fire point of 240° F., practically no ash and very little sulphur.

All of the fuel oil is hauled from port to the plant tank yards in rail tank cars. The main reservoirs at the plant are steam heated and those used for the lighter oil are equipped with floating intakes for the purpose of decantation.

From the tank yard, the fuel is pumped to the power house storage tanks where there is a sufficient capacity to hold approximately half a day's consumption.

Before the fuel is delivered to the engines, it passes through two sets of De Laval centrifugal separators where most of the dirt and water is removed.

The mechanical injection system used with the

60 K W General Motors Diesel Powered Generator Set designed for R. G. Wolff Studios, Hollywood, California by Stewart & Stevenson Services. Unit furnishes electric power for "on location" sets in the production of motion pictures.

ELECTRIC POWER UNITS
PORTABLE OR STATIONARY
MADE TO ORDER

For every conceivable purpose . . . . each designed to meet the exacting need of the industry served.

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FABRICATORS:
Electric Generator Sets
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Portable Pumping Units
Truck Bodies

Anywhere... PARTS • SERVICE *...Anytime*

THE NATION'S LARGEST DISTRIBUTORS OF G. M. DIESEL ENGINES

Nordberg engine must have an initial pressure of around 15 psi. ahead of the fuel injection pumps.

To provide this extra head two small Blackmer motor driven booster gear pumps and a duplex Nugent, size 4S, fuel filter were installed in the engine fuel supply line near the starting air bottles. Only one pump operates at a time, the second one cutting in automatically, in case the pressure in the fuel header drops below normal. The fuel oil header, to which each of the fuel injection pumps is connected, is protected against over pressure by a relief valve set at 50 psi., and the by-passed oil is returned to the service tank.

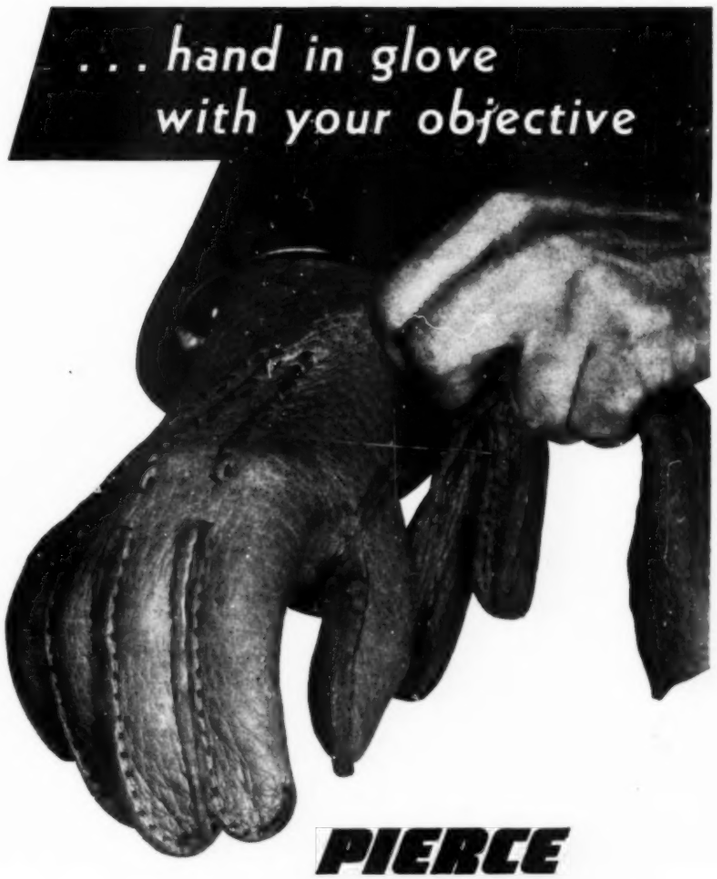
The injection system is the well known American Bosch fuel injection system which does not require further description. It is worthy of note, however, that this fuel system together with the type of scavenging system, as built by the Nordberg, made this unit a very efficient engine.

Test-results

On account of the fact that the electrical switch gear for the Nordberg unit has not been delivered as yet, a makeshift arrangement had to be made to connect it to the power house bus system. This temporary arrangement, unfortunately, does not have the capacity to handle the full output of the generator, consequently, the results of the final acceptance test are not available as yet. Nevertheless, some preliminary performance tests were carried out with 2,000 kw. and 4,000 kw. gross output of the generator. These runs were made with orifice plates of various diameters in the exhaust pipes and with different scavenging air pressures. The most economical operating conditions for this altitude weer thus found to exist with 24 in. diameter orifice restrictions in the exhaust pipes and with a scavenging air pressure of 2.35 psi. Under these conditions it takes 385 kws. to drive the turbo blower and with 80% of rated full load on the generator the engine consumes .518 lbs. of fuel per net kwh. delivered to the bus bars. Net kwhs. in this case is the gross output of the generator measured at the switch-board minus the power absorbed by the turbo blower and all of the auxiliaries, except that consumed by the cooling water pumps.

As mentioned previously the above figures are not the final results, nevertheless they indicate that this engine is a very efficient unit and its addition to the Lautaro Nitrate Company's Diesel power system of "Pedro de Valdivia" will be of considerable economic importance in the Nitrate Industry of Chile.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now. Thoroughly revised — more complete—indispensable. Convenient order coupon on page 64 this issue. Mail it today.



PIERCE
GOVERNORS

It is the aim—and a competitive necessity—of every engine manufacturer to design and build engines that will deliver the most work and the highest efficiency over the longest period—with the lowest service cost.

Effective mechanical speed control works hand-in-glove with the engine manufacturer and the engine user in realization of this objective.

For dependability, long life and consistent economy, Pierce Governors have become the standard for engine control—and are standard equipment on many of the world's finest diesel engines—small, medium and large—in every known application.

WHEREVER GOVERNING IS REQUIRED
PIERCE
IS YOUR FIRST CONSIDERATION

THE PIERCE GOVERNOR COMPANY, INC.
1603 OHIO AVENUE, ANDERSON, INDIANA

New Flexible Tubing Company Starts Operations

FLEXIBLE Tubing Corporation, organized late in 1947, has just announced its entry into the flexible tubing field. Laboratory, design engineering and manufacturing facilities will all be centered in Branford, Connecticut. President and Treasurer of Flexible Tubing Corporation is Frederick K. Daggett, former Sales & Engineering Manager of the Spiratube Division of the Warner Brothers Company, Bridgeport, Conn. Secretary is Joseph B. Morse, New Haven Attorney and member of the law firm of Pond, Morgan & Morse, Assistant Treasurer, Alexander K. Murphy,

Born as a war need, the original of this type of tubing was developed by a nationally know manufacturer, with a background of over seven years' experience in the manufacturing process which this type of product has thus far be constructed.

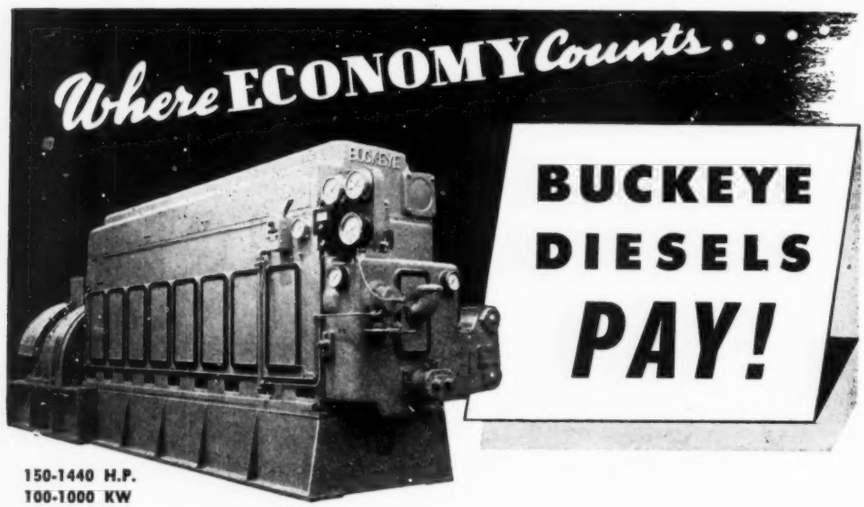
One outstanding indication of the timely merit this product was its use for 3½ years by the U. Navy, on vessels, in shipyards, at advance bas and later in the preservation of the reserve flee

Now, after two years' experimental field work an a study of industrial problems the line of produc to be marketed by the Flexible Tubing Corpora tion will embody in design and construction fe tures and innovations for the safe, efficient an economical conveyance of air, gases, powdered granular light solids or similar elements.

Engineering Societies Meetings Scheduled

S.A.E. National Meetings

Summer Meeting	French Lick Springs Hotel	French Lick, Indiana	June 6-11
National West Coast Meeting	St. Francis Hotel	San Francisco, Cal.	August 18-20
National Tractor and Diesel Engine Meeting	Hotel Schroeder	Milwaukee, Wisconsin	Sept. 7-9
1949 Annual Meeting	Hotel Book-Cadillac	Detroit, Michigan	Jan. 10-14, 1949



150-1440 H.P.
100-1000 KW

BUCKEYE POWER = EXTRA PROFITS

Today's narrowed profit margins make low cost power more important than ever before as a logical source of extra profits. Ever since 1908 — in thousands of stationary and marine installations — owners and operators have learned that the name "Buckeye" on an engine means ECONOMICAL POWER.

Buckeye owners will tell you that their savings in power cost represent a worthwhile profit that was formerly labeled "Operating Expense."

BUCKEYE ECONOMY and DEPENDABILITY

Every feature of Buckeye design and construction has been developed to bring the highest standards of dependability and economy to users of Diesel power. For example, Buckeye valve areas are larger because there are no valve cages. This increases combustion efficiency by providing faster air flow and quicker expulsion of gases. Crankshaft and connecting rod bearings are reversible, shell-type, silver alloy — made by an exclusive Buckeye process — and will last, with proper care, for the life of the engine. These and many other featurs are responsible for the low cost, dependable operation of Buckeye Diesels.

Buckeye engines are appreciated most where the going is tough . . . the service twenty-four hours a day . . . and a low cost source of dependable power is required.

Our engineering staff is always at your service. No obligation—no cost. Just write.

MARINE

"Be Profit-Wise and Dieselize with Buckeyes"

STATIONARY

Engine Builders Since 1908

THE BUCKEYE MACHINE CO.
LIMA . . . . . OHIO

Replacement Parts Program for Diesel Locomotives Discussed

ONE of the most important railroad motive powe problems being solved today is the matter of spar and replacement parts for the Diesel-electric loco motives in service. Gordon P. Link, manager o the renewal parts department for the American Locomotive Company recently described the par his company was playing in this development.

Link said that all of the working parts in each type of new Diesel-electrics are interchangeable and added that his company is mass producing these parts for replacement purposes. Comparing the Diesel-electric with the steam locomotive, Link stated that while the average steam locomotive is in the round house from 10 to 20 per cent of the time, operational records clearly indicate that the Alco Diesel-electrics spend less than four per cent of the time in the shops and are available for main line passenger and freight service more than 96 per cent of the time.

G. P. Link

"To sustain and even improve this high availaility we must be ready and, in fact, are ready to deliver spare parts on a moments notice or on a continuous flow basis without burdening the railroads with cumbersome and costly inventories," he said.

On the future of the spare parts program, Link stated that it will increase in both volume and importance as time goes by.

At the end of 1945," he said, "there were 39,000 steam locomotives and 3800 Diesel-electrics in use on Class I U. S. railroads. According to the latest available figures, the steam locomotive population has declined to 35,000 and there are 5,400 Diesel-electrics in service.

Chicago, Northwestern Railroad to Expand Diesel Facilities

AUTHORIZATION for the purchase of 39 Diesel locomotive units of various types and 2,350 freight cars, supplementing substantial freight and passenger equipment now on order, is provided in the $123,500,000 maintenance and improvement budget of the Chicago and North Western Railway System for 1948.

This program was announced recently by R. L. Williams, president of the railway system, who said the system budget for capital improvements and acquisition of new equipment is $45,890,000.

"Authorization has been obtained for the purchase of eighteen Diesel switching locomotives, fifteen 1,500 horsepower Diesel freight locomotive units, six 2,000 horsepower Diesel passenger locomotives and 2,350 freight cars," said Mr. Williams. "In addition, we have on order nineteen Diesel switching locomotives, one 1,000 horsepower Diesel passenger locomotive, 1,400 freight cars and fifty-two streamlined passenger train cars of various types." Among major budgeted items is the construction of a Diesel locomotive service and repair shop at Proviso, Illinois, at a cost of $642,000; the completion of construction of a $1,860,000 modern Diesel locomotive service and repair shop in Chicago, and the completion of a $1,940,000 centralized traffic control project between West Chicago and Nelson, Illinois. Construction on the latter two projects was started in 1947.

New Line of Wrenches for Locomotive Diesels

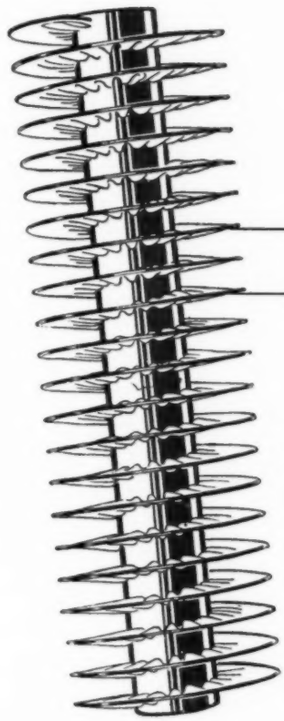
THE B. K. Sweeney Manufacturing Company has developed a line of "Powerenches" designed for use on Alco Diesel engines. The new wrenches make for easy access to crab nuts and main bearing cap nuts and are claimed to decrease downtime of engines under overhaul. The wrenches are

Sweeney "Powerench" in action.

equipped with a built-in tension indicator which permits tightening of nuts to manufacturer's specifications. "Powerenches" are available for Electro-Motive Diesels as well as Alco. With these wrenches it is possible to handle all crab nuts without removing the water manifold pipe or the rocker arm assemblies. For further information write B. K. Sweeney Manufacturing Co., 1601 23rd St., Denver 17, Colorado.

AEROFIN

HIGH COOLING CAPACITY IN LIMITED SPACE



YOU can crowd a lot of cooling capacity into limited space with Aerofin fin-type coils. Installation can be made strictly according to Aerofin's accurate ratings. And perfect bonding and complete tinning assure maintenance of full ratings throughout the life of the installation. An Aerofin engineer is available to help you.

★ *Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.*

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NEW YORK CHICAGO CLEVELAND DETROIT
PHILADELPHIA DALLAS MONTREAL

NAMES IN THE NEWS

FOUR MAJOR APPOINTMENTS in the Control Divisions of the General Electric Company's Apparatus Department have been announced recently by K. R. Van Tassel, manager of the divisions. Mr. Van Tassel named M. H. Blesh, manager of manufacturing, C. B. Bradish, manager of engineering, and E. A. Green, manager of sales. Simultaneously, Guy S. Hyatt, Apparatus Department comptroller, announced the appointment of Thomas I. Hage as accountant for the divisions.

ROBERT G. TABORS has been appointed Sales Manager of the Hydraulic Press and Power Tools Section of The Baldwin Locomotive Works at Eddystone, Pa. He was associated with Baldwin from 1937 until World War II, when he served in the army. Until recently, Mr. Tabors was Sales Manager for the William H. Harman Corporation, Wilmington, Delaware.

RAYMOND B. CREAN has been elected Assistant Vice-President, Production, of The Baldwin Locomotive Works. In 1943, Mr. Crean joined the Baldwin organization as assistant to the Comptroller and was later appointed Assistant to the Vice-President, Operations, which position he held until his recent promotion.

OHIO CRANKSHAFT'S PRESIDENT W. C. Dunn, recently announced the appointment of Dr. H. B. Osborn, Jr. to the post of Technical Director of the company's TOCCO division. Dr. Osborn will devote his time to exploring and developing new fields for induction heating equipment.

GEORGE STOUT, Sales Promotion Manager of the Perfect Circle Corporation, has resigned that position in order to devote full time to establishing his own merchandising and advertising service in New Castle, Indiana.

Mr. Stout joined the Perfect Circle organization in 1925 as Sales Correspondent. From 1929 to 1946 he was the company's Advertising Manager. In April, 1946, Mr. Stout was named Sales Promotion Manager.

BROWN INSTRUMENT DIVISION of Minneapolis-Honeywell Regulator Company announced recently that O. B. Wilson has been named industrial manager for the eastern sales region.

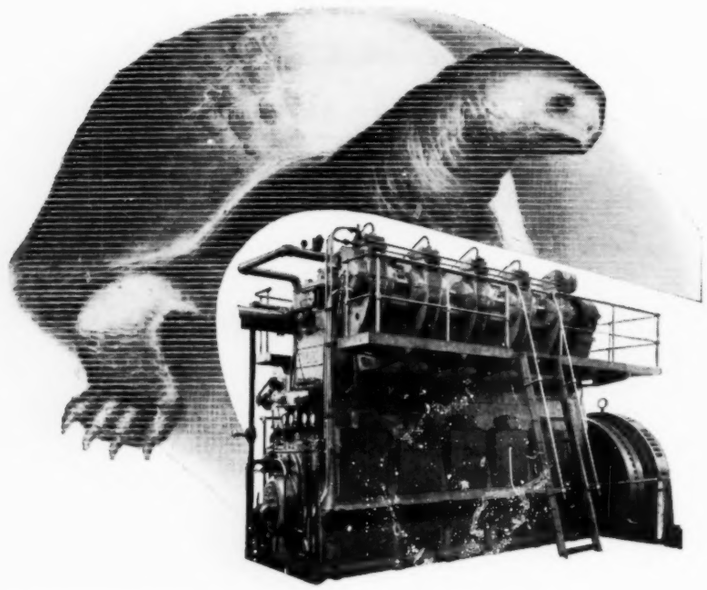
Wilson's promotion will make him regional manager of the territory extending from northern Virginia, through eastern Pennsylvania, to the Canadian border, west to Rochester, N. Y., and in New England.

WEATHERHEAD COMPANY recently announced the appointment of Harry L. Adams as vice president in charge of operations. Adams joined the Weatherhead Company in 1933 as an engineering specialist on screw machine operations, and later became Assistant to the President on manufacturing.

H. L. Adams

EUGENE S. WRIGHT, sales manager of Diesel products for The Baldwin Locomotive Works at Eddystone, Pa., has been promoted to District Sales Manager for the company with offices in St. Louis, Mo. From 1943 to 1946 Mr. Wright was a mechanical engineer with U. S. Army Transportation Corps and spent two years in India assigned to the Bengal & Assam Railway. He rejoined Baldwin as assistant to the sales manager of Diesel locomotives and engines and was promoted to sales manager in May 1947.

E. S. Wright



LOWER SPEED { SLOWER WEAR LONGER LIFE

Every Fulton Diesel is deliberately designed to deliver maximum power at minimum speed. Low RPM means less wear and tear, less maintenance—more fuel economy and dependability.

Consider *cost per year of service*—not just first cost—before you choose a Diesel. Since we began building them in 1914, no Fulton Diesel has ever worn out.

- **Type KS (6 or 8 cylinders): 1725 to 4000 HP at 225 to 257 RPM.**
- **Type BGS (5, 6, 7 or 8 cylinders): 825 to 1980 HP at 257 to 277 RPM.**

FULTON DIESELS - THE BEST BUY IN THE LONG RUN

FULTON IRON WORKS COMPANY
SAINT LOUIS 14, MISSOURI

BROWN FINTUBE COMPANY has announced the appointment of Rolland D. Koenitzer as Assistant Chief Engineer of the Heat Transfer Department. Mr. Koenitzer graduated in engineering from Iowa State College. Since then he has served successively as sales engineer, project engineer, experimental engineer and Chief Engineer for various concerns, and most recently was Assistant Chief Engineer of The McCord Corp., Detroit, Michigan.

R. D. Koenitzer

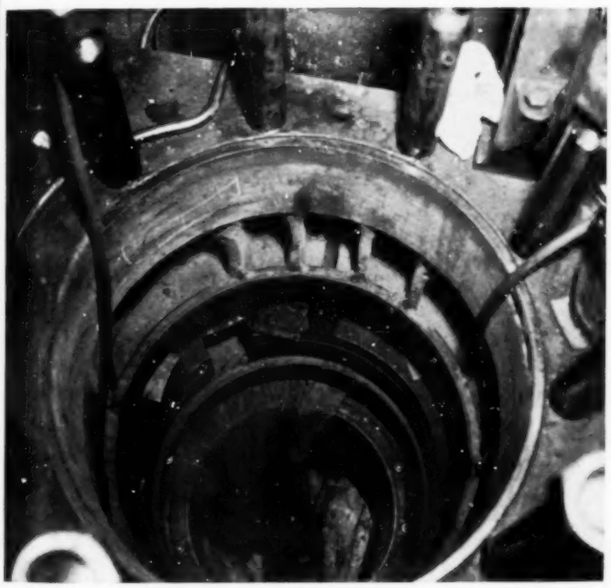
CONFORMING TO ITS POLICY of sales offices in principal cities, the H. K. Porter Company, Inc., of Pittsburgh, Pennsylvania, has appointed William Lee, District Manager of its new Houston, Texas sales office. This announcement was made recently by W. W. Calihan, Director of Sales.

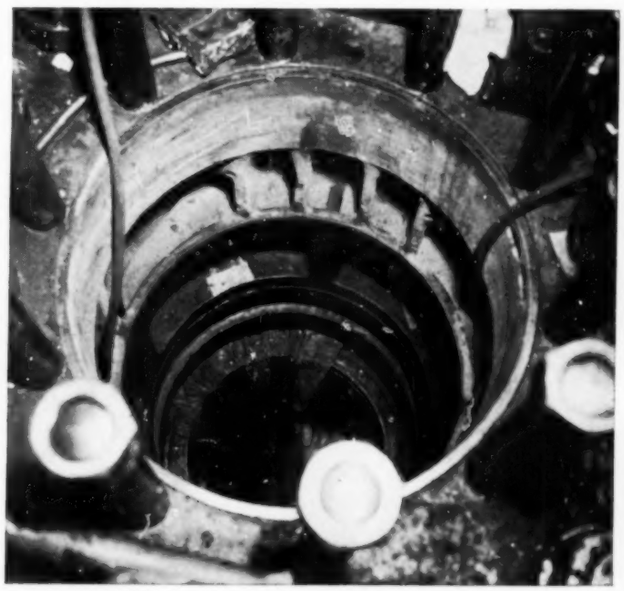
NATIONAL SUPPLY Company, Limited, recently announced that Alvin B. Geddes, sales representative in the Calgary, Alberta, area, has been appointed District Manager in Canada with district headquarters at Calgary. Mr. Geddes joined National Supply in 1943 and was Calgary store manager until last Aug. 2 when he became area sales representative.

A. B. Geddes

L. C. HARBERT, President of Engineering Controls, Inc., recently announced that Hans Bohuslav, widely known Gasoline and Diesel engine authority, has joined that organization as Vice President in charge of engineering. Mr. Bohuslav's designing ability, experience and knowledge of all types of engines, make him a valuable addition to an outstanding staff of engineers, designers and manufacturers of Vapor Phase Engine Cooling and Waste Heat Recovery Systems and a complete line of Automatic Engine Controls.

Hans Bohuslav





Pictured left is the #3 cracked cylinder of a Busch Sulzer 3000 HP 9 Cylinder Diesel Engine repaired by Metalock in 1943 at the Municipal Power Plant for the Village of Freeport, N. Y. It was necessary to remove a section which had been welded, shown in illustration. A new piece was then fitted and **Metalocked** and **Metalaced** in place, as shown in right hand illustration. To date for more than 4 years the repair has proven entirely satisfactory.

Inasmuch as no heat is used in Metalock repairs there is no consequent distortion nor inherent stresses. Metalock eliminates costly machining and downtime.

WRITE TO METALOCK FOR FREE CATALOG

YOU TOO CAN USE METALOCK TO YOUR ADVANTAGE

LICENSED AGENTS IN PRINCIPAL CITIES

Metalock Repair Service, Inc. **Dept. K, 36-15 48th Avenue**

Telephone STillwell 6-0330 **Cable Address: "METLOKCAST NEW YORK"** **Long Island City 1, New York**

DR. JOHN T. RETTALIATA, director of the department of mechanical engineering at Illinois Institute of Technology, will become dean of engineering next September 1, President Henry T. Heald announced recently. Dr. Rettaliata will fill the position vacated by James C. Peebles in August after more than 40 years service at the technological institute. At 36, Dr. Rettaliata is one of the youngest deans of engineering in the United States. A leading mechanical engineer and steam and gas turbine expert, he has headed the department at Illinois Tech since 1945.

APPOINTMENT OF The Globe Machinery & Supply Co., Des Moines, and The Standard Brass & Manufacturing Co. of Beaumont, Texas as distributors for The Parker Appliance Co., Cleveland, was announced recently by D. A. Cameron, Parker industrial sales manager.

The two concerns will handle the complete line of Parker tube fittings, valves and accessories for hydraulic and fluid-handling systems.

FAIRBANKS, MORSE & CO., Chicago, announced recently the following changes in their factory management organization: W. H. Holbert, who for the past 20 years has been manager of the company's Stuttgart, Arkansas Works, has been appointed manager of the Three Rivers, Michigan, plant succeeding Karl E. Barrett who has resigned because of ill health. J. R. Walsh, who has for several years been Assistant Manager of the Fairbanks-Morse Westco Works in St. Louis, has been transferred to the Stuttgart, Arkansas Works and has been appointed Works Manager of the company's plant in that city.

GENERAL MOTORS and their Northwest Diesel distributor, the Evans Engine & Equipment Co. of Seattle, have announced an expansion which covers the entire Northwest area—from Anchorage, Alaska, to Aberdeen, Washington—with a network of new Service Depots.

PENN ELECTRIC SWITCH CO. recently announced that Howard C. Shilling has been appointed district manager of the Goshen, Indiana, territory according to recent announcement by R. H. Luscombe, sales manager of the company. Shilling joined the Penn sales organization approximately 7 years ago.

KELITE PRODUCTS, INC., announced recently the promotion of Clarence Coleman to the position of Regional Manager of the Arizona-Nevada district with headquarters in Phoenix.

THE TWIN DISC CLUTCH COMPANY recently opened a new Branch Sales Engineering office in Los Angeles. The Los Angeles office is located in a newly-constructed building at 2950 Leonis Blvd. and serves a territory including California, Arizona and Nevada.

P. Tyrrell

P. Olney

All Twin Disc activities on the West Coast are under the general supervision of A. E. (Duke) Young, District Manager. Sales functions of the California territory are under the direct supervision of Pierce Tyrrell, Assistant West Coast District Manager. Preston Olney, formerly field service engineer at the Dallas, Texas, Branch Engineering Office of Twin Disc, is manager of the new Los Angeles office.

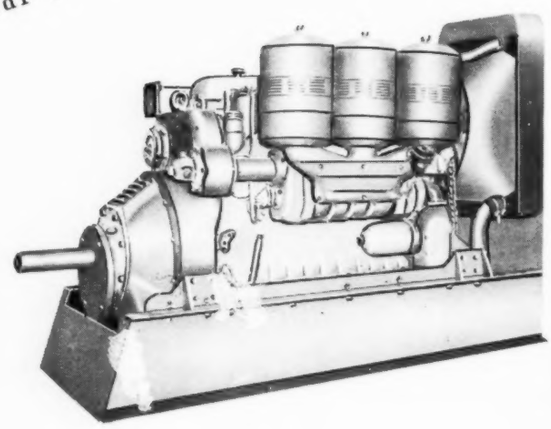
THE APPOINTMENT of Charles W. Young as Plant Manager of the Pennsylvania Flexible Metallic Tubing Company, Philadelphia, was announced recently by S. H. Collom, Jr., Executive Vice-President. Employed by the company for over twenty years, Mr. Young has participated in the supervision of various departments throughout the plant.

165 horses..... to supply you with a round the clock low cost power source.

GM Industrial Power Units

From the millions of horse power of government surplus diesels, these engines were selected, overhauled using factory new replacement parts wherever necessary and then assembled into these heavy duty power units.

The engines are radiator cooled and are supplied with a power take-off clutch and a keyed stub shaft 10" long and 2¾" in diameter.



Many of these units are now in use throughout the world, providing a dependable power source at a lower cost than the owners ever dreamed possible.

They are ideally suited for — ice plants, irrigation projects, mines, quarries, lumber logging camps and mills, oil well drilling and thousands of other operations requiring long life, dependability and low operating cost.

Benjamin's For Motors
1890 Mill Ave., B'klyn, N. Y.
Gentlemen:
Please send me more information and prices on GM 671 Industrial power units.
I intend to put it to the following use .....
Very truly yours,
name .....
address .....
.....

mail the coupon today for further information

Benjamin's For Motors

MARINE and INDUSTRIAL POWER EQUIPMENT

FAIRBANKS-MORSE Annual Report stresses the fact that the company's Diesel locomotive program is developing satisfactorily.

"Orders for over a quarter of a million horsepower have been received to date," President R. H. Morse said. "As a result of the excellent performance and ready acceptance of this product by major American railroads, prospects for increased sales are excellent. As a matter of fact, at the present time ability to take additional orders is limited only by our production facilities and these are being expanded as rapidly as possible."

WM. W. NUGENT & Co. have recently issued two new bulletins, Nos. 15 and 16 describing the Nugent telescopic oiling devices for reciprocating and revolving bearings and the Nugent sightfeed valves, sightflow fittings and compression pipe fittings. For copies of these bulletins write Wm. W. Nugent & Co., Inc., 410-412 N. Hermitage Ave., Chicago 22, Ill.

DEALER AND DISTRIBUTOR sales meetings are now being conducted throughout the United States by members of the sales organization of the Auto-Lite Battery Corporation, according to W. E. Blank, Sales Manager, Replacement Sales. The meetings will be continued until well into the summer, Mr. Blank said.

DOUBLE SEAL RING COMPANY has published a new folder describing its line of piston rings. It is full of practical piston ring information pointing out the savings made possible with proper ring installation. The back page of the folder gives data on the selection of the proper size rings by the operating engineer. Copies of the folder, #12M 101, are available by writing the Double Seal Ring Co., P. O. Box 566, Fort Worth, Texas.

HIGH TEMPERATURE CERAMIC COATINGS for steel have been developed by the National Bureau of Standards during the last few years which are said to protect mild steel against oxidation during prolonged exposure to air at temperatures up to 1,250°F. In addition these coatings have withstood 10 quenches with cold water from 1200°F., resulting in permanent distortion of the metal yet causing no noticeable effect upon the coating. In the Diesel industry they are adaptable for coating the exhaust systems of engines for resistance to oxidation.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now. Thoroughly revised — more complete—indispensable. Convenient order coupon on page 64 this issue. Mail it today.

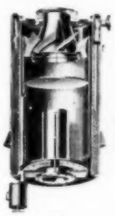
A FOUR-PAGE PAMPHLET announcing the Dual-Fuel Attachment for the "Caterpillar" D13000 Diesel engine has been released by Caterpillar Tractor Co. The pamphlet underscores the versatility of the engine when the attachment is added and points up the economic operation of the entire unit when utilizing natural gas. Speed of installation and ease of operation of the attachment are emphasized in the publication. Copies of the pamphlet may be secured by writing the manufacturer, Peoria 8, Illinois, requesting form No. 10745.

RADAR AND RADIO service has been expanded in the Gulf of Mexico area by the Radiomarine Corporation of America through the opening of a new service station at 239 Tartar Street, Pasadena, Texas, it was announced recently. According to George F. Shecklen, Executive Vice President of Radiomarine, this latest addition to the company's chain of twenty-three service stations in the Gulf and Mississippi areas is equipped to provide installation, maintenance and inspection of all types of radiotelegraph, radiotelephone, direction finder, radar and loran marine apparatus.

EXHAUST AND INTAKE SILENCERS

SPARK ARRESTOR SILENCERS

STEAM BLOW-OFF SILENCERS



HEAT RECOVERY SILENCERS

AIR-JET SILENCERS

FOR MORE EFFICIENT SILENCING

. . . BE SURE IT'S A MAXIM

Over the years Maxim has had the practical experience and research facilities to develop and build the finest silencing equipment available. Throughout industry Maxim Silencers have become a standard for many silencing jobs: on internal combustion engine exhaust and intake — compressor intake — vacuum pump discharge and steam blow-off. Maxim Heat Recovery Silencers recover waste exhaust heat to produce steam or hot water and afford the opportunity for a highly efficient hook-up. Maxim Spark Arrestor Silencers provide 100% positive spark arresting and are invaluable where a fire or dirt nuisance hazard exists.

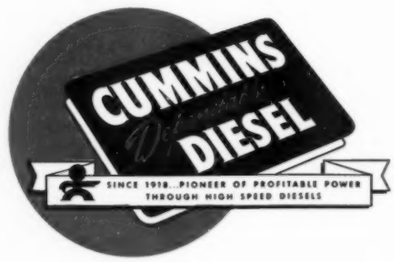
Maxim offers a wide choice of standard silencers to fit the requirements of nearly any installation. The Maxim engineering department is always available to you for consultation and consideration of special silencing problems.

THE MAXIM SILENCER COMPANY
94 HOMESTEAD AVENUE HARTFORD 1, CONN.

MAXIM SILENCERS

BULLETINS AVAILABLE
Please specify type of silencing equipment of interest to you.

11MX48



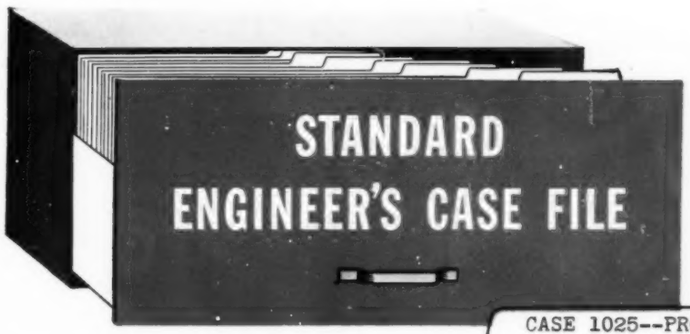
See for Yourself...

how Cummins *Dependable* Diesels perform profitably on the toughest kind of jobs. Your Cummins dealer—a specialist in power application—will take you to jobs in your vicinity . . . can show you:

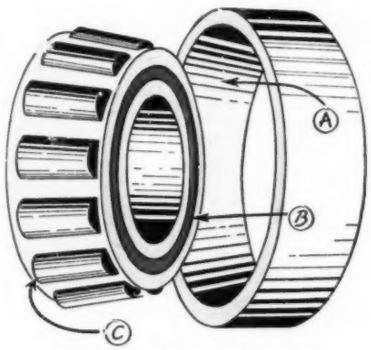
- Equipment of the 101 leading manufacturers who satisfy customer demand with Cummins Diesels as standard or optional power.
- The wide range of jobs on which Cummins Diesels are doing more work at less cost.
- Operation records of Cummins Diesels on jobs like yours.

Acceptance by manufacturers and owners . . . on a wide variety of applications . . . is the strongest evidence that Cummins Diesels offer dependable, economical power for jobs requiring single engines up to 275 hp . . . multiples up to 1440 hp.

CUMMINS ENGINE COMPANY, INC. • COLUMBUS, INDIANA



CASE 1025--PROVIDING CONSTANT LUBRICATION IN WHEEL BEARINGS.



AUTOMOTIVE ROLLER WHEEL BEARING

Wheel bearings in trucks hauling heavy loads in desert heat, winter cold and rain, were in perfect condition long after usual servicing periods when the bearings were lubricated with RPM Wheel Bearing Grease. Recommended for all sizes and types of wheel bearings. Apply to bearing assemblies by hand or with mechanical lubricators.

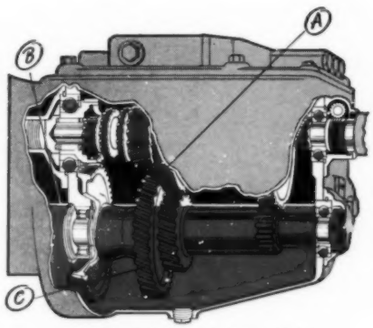
A. Maintains tough, resilient film on bearing surfaces - protects during constant pounding of road shocks and under overload pressures.

B. Feeds slowly to bearing parts ... resists extreme temperatures - will not melt and run from hubs onto brakes.

C. Stays in smallest bearing clearances.

RPM Wheel Bearing Grease provides good lubrication in the presence of water.

CASE 1029--REDUCING WEAR IN CONVENTIONAL AND WORM GEARS.



TYPICAL AUTOMOTIVE TRANSMISSION

Compounded RPM Gear Lubricant satisfactorily met all operating conditions in these gears in cars, trucks and similar machines. Comes in four grades: SAE 80, 90, 140 and 250. (For hypoids, use RPM Multi-Service Gear Lubricant.)

A. Compounds help resist high temperatures and pressures on gears. Minimize deposits and thickening. Make it non-corrosive to metals in gears and cases.

B. No foaming and leaking trouble - contains most effective foam inhibitor known.

C. High affinity for metal maintains lubricating film at all times. Constant oil wedge at gear contact points prevents scoring and extra wear.

RPM Gear Lubricant (Compounded) resists viscosity changes ... allows easy shifting in low temperatures and fast flow of lubricant onto gears.

For additional information and the name of your nearest Distributor, write

STANDARD OIL COMPANY OF CALIFORNIA

225 Bush Street, San Francisco 20, California

The California Oil Company
30 Rockefeller Plaza, New York 20, N. Y.

The California Company
17th and Stout Streets, Denver 1, Colo.

Standard Oil Company of Texas
El Paso, Texas

RPM CALOL

Trademarks Reg. U. S. Pat. Office

POWER TRANSMISSION EQUIPMENT

Brad Foote Gears

WORMS — Milled up to 12" dia. — up to 1 D.P.

WORM GEARS — Generated up to 108" dia. — up to 1 D.P.

HERRINGBONE GEARS — up to 60" P.D. 18" face, 2 D.P.

STRAIGHT BEVEL GEARS — Straight tooth — up to 60" dia., 10" face up to 4½" C.P.

HELICAL OR SPIRAL GEARS — Generated up to 108" dia., 16" face — up to 1 D.P.

SPIRAL BEVEL GEARS — up to 32" dia., 6" face, up to 1½ D.P.

HELICAL GEARS — Ground tooth up to 14" dia., 6" face, 2 D.P.

SPUR OR HELICAL GEARS — Shaved tooth up to 20" dia., 8" face, 2 D.P.

SPUR GEARS — Form Cut—to 96" dia., 24" face — up to 4" C.P.

SPUR GEARS — Hobbed Generated — to 108" dia., 18" face — up to 1 D.P.

SPUR GEARS — Fellows Generated—to 140" dia., 8" face, up to 1 D.P.

SPUR GEARS — Ground tooth up to 18" dia., 12" face — 2 D.P.

INTERNAL GEARS — Form cut up to 72" dia., 12" face — up to 1 D.P.

INTERNAL GEARS — Generated up to 120" dia., 8" face — up to 1 D.P.

ACME SCREWS — Milled up to 6" dia. 30 ft. length

SPEED REDUCERS

WORM GEAR

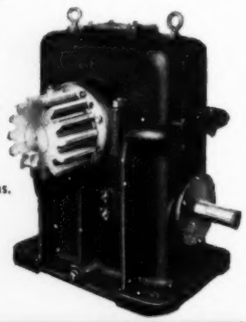
Ratios 3⅝ to 1 to 60 to 1 Single, Double Reductions up to 10,000 to 1.

HERRINGBONE GEAR

— Ratios 2 to 1 to 295 to 1 Single, Double and Triple Reductions.

GYRO — Ratios — 24 to 1 to 3600 to 1

OIL WELL UNITS 28.4 to 1 Double Reduction Peak torque 24,750 lbs. to 69,500 lbs.



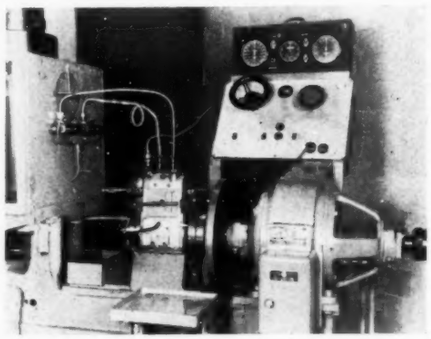
BRAD FOOTE GEAR WORKS

1309 South Cicero Avenue
Cicero 50, Illinois

D.E.M.A. Inaugurates Program of Test Equipment Development

FOR the purpose of improving college laboratory equipment for tes ingand research work on Diesel engines, the Diesel Engine Manu facturers Association is publishing a series of bulletins, tenor of whic is, "You can build it yourself."

Due to the great influx of veterans who wanted to study Diesel eng neering at war end, colleges an universities were caught short o adequate instru mentation fo teaching their courses, according to Harvey T Hill, executive di rector of the As sociation. Engine themselves were procurable from War Assets Ad ministration, and schools obtained obtained about $6,000,000 worth, but the instructors had nothing with which to "instrument" them, once they were set up.



Equipment developed by Northwestern University engineers for studying fuel spray characteristics.

Because testing equipment is hard to get and is costly, some school built their own. The equipment they made, and how they made it i described in the bulletins, which are edited by George H. Amberg Secretary of DEMA's educational committee.

First bulletin of the series told how Princeton University built its own dynamometer. Bulletin No. 2 described a fuel injection spray chamber developed by The Technological Institute of Northwestern University No. 3 covered an electro-optical indicator constructed by the University of Wisconsin.

She has to take chances

. . . YOU CAN PLAY SAFE

And Save on High Speed Diesel Repair Costs!

Downtime for piston ring changes *can* be a big expense. Play safe! Guard against disrupted schedules and frequent piston ring replacements. Install Porous Chrome* Piston Rings. Manufactured from F-88 metal, a new centrifugally cast iron with 2½ times greater tensile strength and 50% higher modulus of elasticity, Porous Chrome rings are *unbreakable* in service. They seat immediately, thus eliminating the costly wear of break-in periods. You get new engine performance and economy . . . reduce cylinder wear as much as one-half. You economize, too, by eliminating the need for chrome plating cylinder liners.

Don't take chances! Take a tip from leading Diesel engine builders, who *play safe* with Koppers American Hammered Porous Chrome Rings. There is a piston ring combination, including the Porous Chrome compression ring, for any high speed engine—for new equipment or replacement jobs. Koppers Company, Inc., Piston Ring Division, Box 626, Baltimore 3, Maryland.

*VAN DER HORST PROCESS

K KOPPERS

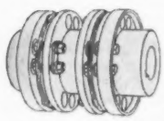
IN EVERY SIZE • OF EVERY TYPE • FOR EVERY PURPOSE

American Hammered Piston Rings

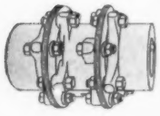
Making piston rings is just one way in which Koppers serves industry. Koppers also produces chemicals from coal. It manufactures flexible couplings, roofing, paving materials, airplane propellers. It is a leader in the wood preserving industry. It designs and builds most of America's coke ovens. There are many Koppers products or services that can help your business. Koppers Company, Inc., General Offices, Pittsburgh 19, Pa.

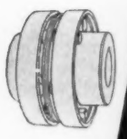
THOMAS
Flexible ALL METAL
COUPLINGS

Engineered to stand up on the toughest jobs, Thomas Flexible Couplings do not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.



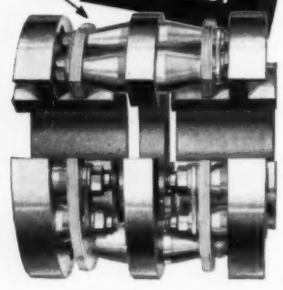
The standard line of Thomas Couplings meets practically all requirements. But if unusual conditions exist we are equipped to engineer and build special couplings.





BACKLASH FRICTION WEAR and CROSS-PULL are eliminated NO LUBRICATION REQUIRED!

PATENTED FLEXIBLE DISCS



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

Write for New Engineering Catalog

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

$1,000 for 11 Words

EXPANDED during the war, employee suggestion plans in many automotive plants continue to pay workers well for ideas to improve plant operations or safety.

One recent example was a $1,000 bond awarded to a foundry worker in one plant for an eleven-word suggestion: "Use a bulldozer to remove the drop from under the cupolas."

This refers to the fact that at the end of each working day the cupolas where iron is melted must have their bottoms opened, so the accumulated unburned coke, slag and iron drops to the floor. Picks and shovels had been used previously to remove the "drop." — *Automobile Facts*

P. J. Flaherty Dies

PATRICK J. FLAHERTY, chairman of the board of directors of the Johnson Bronze Company, died suddenly in the Alten Road hospital, Miami Beach, Florida. Mr. Flaherty, who was born in Ireland, February 1, 1879 and later came to this country, brought the Johnson Bronze Company from its place of relative obscurity in 1912 to a place where it is recognized today in the bronze industry as a leader with a plant employing approximately 2000 men and women.

Baldwin Announces Promotions

R. NEVIN WATT has been elected Assistant Vice President-Domestic Sales of The Baldwin Locomotive Works. In 1942, Mr. Watt was made General Sales Manager of The Baldwin Locomotive Works, which position he held at the time of his recent promotion.

R. N. Watt R. C. Disney

Roland C. Disney has been promoted to the position of Manager of Domestic Sales. Mr. Disney joined the Baldwin organization on February 15, 1946 as eastern district sales manager, and in June, 1947 was appointed assistant general manager of sales, which position he held until his recent promotion.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now. Thoroughly revised — more complete—indispensable. Convenient order coupon on page 64 this issue. Mail it today.

New Piston Ring Expander

A NEW piston ring expander, X-Pano, as the new product is called, quickly and easily handles the removal or installation of piston rings of any size from seven to twenty-four inches in diameter, and thus greatly facilitates overhaul work on any type of large Diesel engine. X-Pano will not corrode in either land or sea duty, according to the manufacturers, being constructed of durable aluminum alloy throughout. The piston ring expander weighs but 1½ pounds, with an overall length of 19 inches, and a special ratchet feature permits holding the ring in any expanded position desired. X-Pano is made and distributed by Thilenius Equipment Company, 303 E. 4th St., Tulsa, Oklahoma.

X-pano, new ring expander

Recent Diesel Developments Abroad

GAS-DIESEL locomotives are the latest development in Russia. Availability of natural gas to railroad lines has resulted in dual fuel operation for Russian Diesel locomotives. Gas is stored in cylinders under high pressure which are stowed in a special tender weighing 74 tons. In all 57 cylinders of gas are carried. Mixing of gas and air and its introduction to the cylinder where it is ignited by Diesel pilot fuel is essentially the same as our own dual fuel systems. It is possible with this system to have operating ranges up to 400 miles without refueling.—The Engineer's Digest, November 1947.

A new Russian tractor caterpillar-type weighing 11 tons and powered with a 93 hp. Diesel is now in production. It is 4 cycle, 4 cylinder with only 4 piston rings per cylinder. Air intake is preheated for starting.

1,000th Watch

R. C. Norberg, president of The Electric Storage Battery Company, is shown presenting a gold watch to Miss Caroline L. Fleck upon completion of 25 years of service in Exide Battery Plant, Philadelphia. More than 19 per cent of the company's 4,000 employes are members of the Exide Quarter Century Club.

TUTHILL GENERAL PURPOSE PUMPS
...Model C

- Low first cost.
- Low upkeep.
- Compact.
- Dependable in service on non-corrosive liquids.
- Operates in either direction of rotation.
- Capacities from 1 to 200 g.p.m.
- Pressures up to 100 p.s.i.
- Direct drive, slow speed V-belt units and stripped models.

Write for Model C bulletins

TUTHILL PUMP COMPANY
939 East 95th St. • Chicago 19, Ill.

BURGESS SNUBBERS - BURGESS SNUBBERS

How to be sure of a quiet exhaust

There is no substitute for good exhaust system control if you are to have a quiet exhaust free of noise complaints.

To be sure of a quiet exhaust, use a Burgess Exhaust Snubber. It provides the freedom from noise required by every engine operating near workers or residences. The exclusive Burgess snubbing principle provides complete noise control, preventing noise before it occurs. Explosive "slugs" of exhaust gas are sent smoothly into the atmosphere, their energies dissipated within the multi-chambered Snubber.

Burgess Snubbers are available for every size and type of Diesel engine. Write today for detailed information.

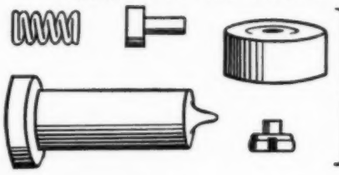
BURGESS-MANNING COMPANY
749-A EAST PARK AVE., LIBERTYVILLE, ILLINOIS

Below Your Costs — *Best Buy Today*
Government Surplus- New

"71" DIESEL GM PARTS

Complete Assembly or Individual Parts

SPRAY TIP and VALVE ASSEMBLY



No. 5227325
Spray Tip and Valve Assembly consists of
1 Stop Check
1 Valve Spring
1 Spray Tip—7 hole
1 Valve and Seat
Sold in part or as complete assembly

These and many more

NUMBER	DESCRIPTION
5226888	Injector Filter Element
8502957	Oil Cooler Element 12 Stack
5227325	Spray Tip and Valve Assembly
5227231	No. 80 Injector and Case
5157393	Blower Assembly—Left
5157396	Blower Assembly—Right

Write for complete parts list and low net prices.

SURPLUS AUTOMOTIVE COMPANY "DEISEL PARTS SPECIALISTS"
1329 S. MICHIGAN AVE. CHICAGO 5, ILLINOIS

FUEL AND WATER LEVEL INDICATION *at a Glance*

WITH A LIQUIDOMETER DIAL TYPE TANK GAUGE

Direct Reading • Remote Reading

HYDRAULIC, HYDROSTATIC OR ELECTRIC TRANSMISSION

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For complete information, prices and delivery dates, write or phone

THE LIQUIDOMETER CORP.
Marine Division
41-57 37th ST., LONG ISLAND CITY 1, N. Y.
STillwell 4-1440

Filters Cleaned Easily!

It's a fact that Diesels give more economical service if lube-oil and fuel-oil and air-intake filters are regularly cleaned. And filters give longer service, too. Reason enough for using specialized Oakite cleaning materials and methods on your filter maintenance work.

Rapid emulsifiers, Oakite cleaning materials easily remove oil, grease and dirt from filters; restore brightness to copper mesh; clean without damaging metal.

FREE Details

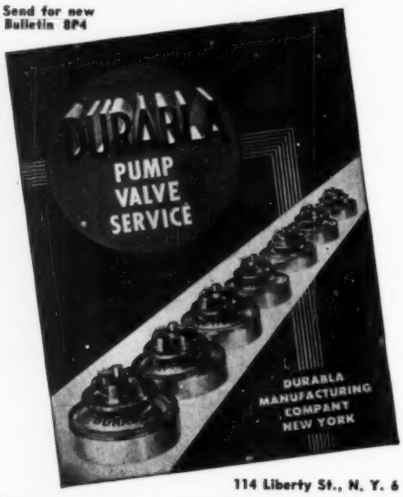
Facts about the use of Oakite steam-agitated hot solutions or air-agitated cold solutions for cleaning your filters—yours for the asking. Drop us a note or contact your nearby Oakite Technical Service Representative. No obligation.

OAKITE PRODUCTS, INC.
220 Thames Street, NEW YORK 6, N. Y.
Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE

Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

Send for new Bulletin BP4



114 Liberty St., N. Y. 6

FOR SALE
DIESEL GENERATOR

Busch Sulzer engine 440 hp. 6 cyl. direct connected to Elliott generator 300 K.W., 360 rpm., 1200 amp., 250 V. D. C., with necessary air bottles, exhaust piping, muffler, lubricating system, with Sharples centrifuge oil filter, and some spare parts.

$7500., as is and where is, subject to demonstration. Address: Box 483, DIESEL PROGRESS, 2 West 45th St., New York 19.

WEST COAST DIESEL NEWS

By FRED M. BURT

REX B. CLARK'S large Rancho Piocha, Santa Ynez, Calif., has just had a new power and lighting plant installed, consisting of two Superior, 6 cyl., 205 hp. Diesels, direct connected to 150 kw. General Electric alternators.

THE INVITATIONS (about 1200 of them) read—

Mr. Fred G. Gurley, President,
The Atchison, Topeka and Santa Fe Railway Co.,
requests the pleasure of your company
at a luncheon observing
one hundred million miles of Diesel operation
by the Santa Fe System Lines
and inauguration of daily service on the
Super Chief.

Friday, the twelfth of March — Biltmore Bowl
at — Biltmore Hotel
twelve-thirty o'clock — Los Angeles

and Bob Hope was guest M.C. Nuf Ced.

SUPPLIED BY Shepherd Tractor & Equipment Co. for Terminal Island and San Pedro fishing boats, for Charles Austrem's *Commander*, a "Caterpillar" Diesel auxiliary; a D318 for Van Camp Sea Food Company's *City of Los Angeles;* a 53 hp. Diesel for propulsion power, for Castagnola Bros. Sea Food Company *El Sole*, replacing a 45 hp. "Caterpillar" Diesel.

THE LATEST MODEL Woolbridge "Terra Cobra" for Claude Fisher Ltd. and R. S. Crowe, general contractors, for use at Indio, Calif., is powered with a 200 hp., supercharged, Cummins.

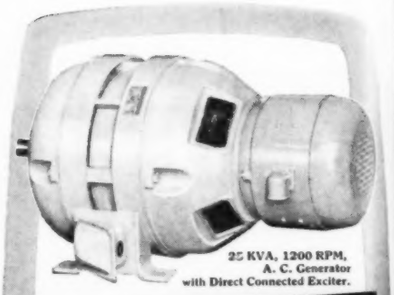
INSTALLED BY the Monterey (Calif.) Pacific Engineering Co., in the hook-and-line boat of R. Campesi, was a 20 hp. Lorimer Diesel engine.

TO BE POWERED with a 200 hp. Gray Diesel engine, a 50 ft. combination fishing boat is being built by the Danielson Shipyards at Cathlamet on the Columbia River, for Charles Petersen, Seattle.

A NEW COMBINATION boat under construction by A. Mauricio, Fort Bragg boat builder, for Richard Richter of Fort Bragg, will be powered with a Model 2071, General Motors Diesel.

TWO NEW AUTOCAR trucks equipped by Lacy Transportation Co., Long Beach, for diversified oil field work, are powered with Cummins HBS Diesel engines supercharged to 200 hp.; and three Autocar, 7 yd. dump trucks for Clyde Wood, Placer Co., Calif., general contractor, are powered with 150 hp. Cummins Diesels.

THE HOOK-AND-LINER *Sea Wolf*, refitted from war service as a refrigerated food carrier at the Martinolich yard at San Francisco, has three Superior Diesels for propulsion and auxiliary power.



25 KVA, 1200 RPM, A. C. Generator with Direct Connected Exciter.

COLUMBIA
GENERATORS
A.C. and D.C.

Columbia, with its years of experience, brings to you a wide line of performance proved, sturdily built, A.C. and D.C. Generators. **A.C. Generators: 6¼ to 375 KVA. D.C. Generators and Exciters: 2 to 200 KW.** Available in Single or Two Bearing Construction. *Write today for information. Our engineers will be glad to review your requirements. Prompt delivery.*

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave., Cleveland 14, Ohio

30 YEARS EXPERIENCE IN
DIESEL REPAIR

Guth Fusion Process, an original method of rebuilding and repairing diesel engine cylinder heads, cylinders and large castings, is the successful result of 30 years of scientific development.

Our service — quick, efficient, and economical — is available to you. Write today.

GUTH COMPANY
McPHERSON, KANSAS
Serving the Nation from Its Center

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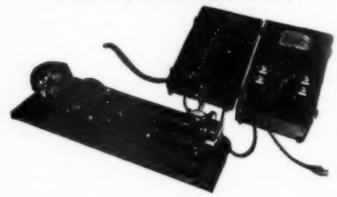

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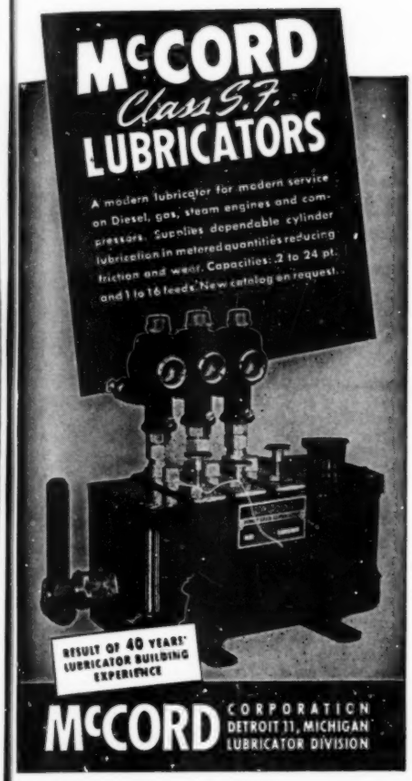
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TWO NEW AUTOCAR trucks for Empire Transportation Co., Bakersfield, Calif., are powered with 275 hp., supercharged, Cummins Diesel engines.

TUNNEL STERN TUG, 60 ft. *Shasta,* River Lines, San Francisco, is being re-powered with two 165 hp. General Motors Diesels, equipped with 3:1 Walters reduction gears, purchased from Thomson Machine Works, San Francisco.

UNDER CONSTRUCTION by Genoa Boat Works, San Francisco for Carmelo Patania, is a new 42 ft. combination boat to be powered with a General Motors Diesel engine, with 3:1 G.M. hydraulic reverse gear, and Twin Disc front power take-off, purchased from West Coast Engine & Equipment Co.

PROPELLED BY two Kockum-M.A.N. double-acting type, Diesel engines with 14,000 total shaft horsepower, at 110 rpm., for a speed of 19½ knots, is the Swedish, Johnson Line motorship, *Seattle,* for Europe-North Pacific service; the first of five, 9100 d.w. vessels ordered for this service.

POWERED WITH a 165 hp. General Motors Diesel, to log 11 mph. at 1875 rpm., through ½:1 reduction gears, is the Ilwaco Oyster Company's 36 ft. tug, designed by H. C. Hanson, Seattle naval architect, built by Ilwaco (Wash.) Boat Works.

THE 1947 TUNA CATCH, totaling 116,837 tons, of Southern California's Diesel-powered tuna fleets—clippers, purse seiners, and Albacore vessels, tops all previous records; 75,840 tons unloaded at San Diego, 40,997 tons at Los Angeles.

IN A WINTER OVERHAUL, 117 ft. tuna clipper, *Invader,* at Campbell Machine Co., San Diego, received two new 120 hp. 75 kw., Atlas Imperial, auxiliary Diesel-generating sets, while retaining her 7 cyl., 350 hp. Union, main Diesel engine.

TUNA CLIPPER *Lusitania,* at Martinolich Shipbuilding Co. yard in San Diego, has just received a new 600 hp., 6 cyl. Enterprise Diesel engine for propulsion power.

TUNA CLIPPER *City of San Diego,* in addition to three 60 kw. GM auxiliary generating sets, has also been re-powered with a 550 hp. 6 cyl. Union Diesel, with Monel tail shaft and Coolidge wheel, at the Campbell Machine Co. yard, San Diego.

POWERED WITH a 400 hp. Superior Diesel, and with two Superior auxiliary Diesel-generating sets, the 98 ft. seiner *Western Pacific* has just been refitted as a tuna clipper for South Pacific Canning Co., Long Beach.

SUPPLIED BY West Coast Engine & Equipment Co., Oakland, a GM Model 2071 Diesel engine with 3:1 Snow & Nabstedt reduction gear has been used to power August Tarantini's hook-and-line boat *Rex.*

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